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by

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submitted by _____ JANE HELEN TILLEY MERKS _____ in partial fulfilment of the requirements for the degree of Master of Design.

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"The purpose of interactive multimedia instruction
is not to dazzle, to impress, to amaze, or to delight,
but to communicate."

R. A. Schwier and E.R. Misanchuk (212)

The Presentation of
the Visual Aspects of
Interactive Multimedia Instruction

Abstract

This thesis is intended as a resource for educators and education students interested in the visual aspects of interactive multimedia instruction. Basic rules that have applied to the visualization and flow of information of print-based material must be revised to apply effectively to screen display design. This thesis discusses the creation of multimedia teaching tools. Visual considerations, such as text readability, colour and layout, as well as navigation design and the criteria for selecting authoring programs are reviewed to help teachers develop this innovative learning resource.

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Table of Contents

List of Acronyms

Acronyms have become part of the everyday language of anyone using computers. The items included here may not appear in the text of this thesis but they are all used in the research and often in article titles. For the purposes of consistency and clarity, I have used IMMI (interactive multimedia instruction) in place of the various interchangeable acronyms, whenever possible.

CAI   computer aided instruction

CAL   computer aided learning

CAT   computer aided training

CBI   computer based instruction

CBL   computer based learning

CBT   computer based training

CLI   computer-learner interface

CMI   computer managed instruction

CRT   cathode ray tube

DVD   dynamic visual display

EPS   encapsulated postscript

HCI   human computer interaction

HMI   human machine interface

IMMI   interactive multimedia instruction

MMI   man machine interface

PICT   picture file

TIFF   tag image file format

VDT   video display terminal

Chapter 1 – Introduction

Some visual communication designers may argue that a designer must always be included in the development of any interactive multimedia instructional (IMMI) application. While that may be an ideal solution to the problem of poorly designed interfaces, in reality, it is unrealistic and impractical. Authoring programs, such as Hypercard and Authorware, allow others, not just programmers, to produce interactive applications. Many educators use such products as teaching tools in their own classrooms. Just as desktop publishing allows public relations professionals to produce newsletters without the help of graphic designers, authoring systems help teachers produce IMMI applications. In the majority of circumstances, educators cannot or will not hire a designer for their small projects.

Interactive Multimedia Instruction involves various media, such as text, images, video, audio and motion pictures, where the user controls the navigation of this learning resource.

Traditionally, the use of multimedia for teaching has included the use of print material, audio recordings, overheads, slides, film strips, motion pictures and video recordings. Today, the contemporary meaning of multimedia, specifically interactive multimedia instruction, takes in any computer based learning where text is used with audio, image and sometimes motion pictures.

Authoring is the act of creating an IMMI application, using an existing software package.

According to John Barker, "People who write books are called authors. Writing a book is a creative act, so often the inspiration of a single individual. The author is dredging up treasure from a wealth of unique experience and laying this down on paper as raw words and pictures. This code is then processed by an army of illustrators, typographers, typesetters and printers to bring it to a publishable quality. No one expects the author to be expert in the act of typesetting. They expect the author to be an expert in the subject of the book.

Courseware is the electronic equivalent of the textbook. The difference is that the words and pictures are presented on the screen rather than on paper and the learner can interact with the material on the screen. [IMMI] has been discredited because the creative author has been frozen out of the creative process. Books are not written by publishers, not by typesetters. So why should courseware be written by programmers?" (114).

Barker uses this argument to validate the need to allow authors to work with or as programmers through user-friendly software. In the same article, Rob Ransom expands further on Barker's statements. "Most text books are written by a small number of people, usually one or two. If you look at the best stuff done in the courseware multimedia area it is done by groups of people. Designers, educational technologists and teachers coming together to form a critical mass. That is the way to do it" (130) . The collaborative efforts of educators, visual communication designers and programmers may not always be possible, but it is the best way to produce the most effective courseware.

To bridge the gap, this thesis provides basic design principles of the visual aspects of interactive multimedia instruction. While it is not ideal to work without the help of visual communicators, individual educators may create learning resources effectively.

The two case studies in chapters 6 and 7 demonstrate the navigational and screen display guides developed in the previous chapters. The *Math30* case study represents the redesigning of a project previously designed by educators. The children's story *We're Moving!* originated as a hard copy storybook and then became the pivotal point for an instructional application incorporating aspects of geography and art for a Grade Three curriculum.

The guidelines presented here are to be used for the development of simple, yet effective communication of interactive multimedia instructional applications.

Chapter 2 – Background Information

Introduction

While computer aided instruction has been around for a number of years, the parameters of use are constantly changing, due to advances in the speed and capabilities of the machines, the lowering of their cost, and expansion of their accessibility. Steven Soulier states "Human interfacing is not so much what is being presented as how" (81). But the first issue to be addressed must be not 'how' but *what* will be presented.

Human Computer Interaction or Human Computer Interfacing considers how people can best interact with the technology, based on the screen design and navigation system.

What to Present, and How

James Galbreath observes that as we move into the age of information and visual learning, we also need to be aware of the decrease in the number of teachers, especially experts in specific fields. " … With teacher substitution on the rise in urban secondary and primary schools, students may not know who will be teaching their class on a given day" (17). This creates a perfect opportunity for the development of IMMI.

He continues, "Multimedia technology can aid students' ability to receive, process and act on the tremendous amount of information presented to them in their school years. Students have the opportunity to gain critical technology skills that they will need to survive in the highly competitive marketplace they will face in the future" (18).

But before revising existing or writing new teaching material and designing the IMMI application, one must find out who the material will be written and designed for. In the past, creators of these applications (often programmers not educators) did not know their audience and were too far removed from the people for whom they were designing for. Consequently, stated Paul Booth, "In the opinion of many researchers in the HCI field, although computer technology has made great advances over the past 30 years, the designer's knowledge and understanding of the user has not significantly changed" (2). He believes that designing must shift from the perspective of the programmer to the needs of the user.

The basis of user centred applications must be explicit identification and definition of the audience. Soulier notes the following issues which need to be addressed (81-82):

Know your audience
- How do they think?
- What motivates them?
- What are their expectations regarding the program?
- What learning expectations do they have generally?
- Why will users work with the program?

Understand their environment
- Will they be in a formal classroom or in their home?
- Is a teacher present?
- What are the time constraints?
- Is there more than one type of user?

Get the feedback
- How do they feel about the interface?
- How do they react to methods used in controlling the interaction?
- Carefully observe their reactions

Features and Evaluation of IMMI

Features

Once the audience is established, the next step is to evaluate whether IMMI is the best method to deliver the information.

Computer Aided Learning is an older term which did not always include a sophisticated level of interactivity.

The main feature of computer aided learning, as suggested by David Marshall, is its capability to present structured information to students individually. IMMI is less passive since students respond actively and their performance can be evaluated immediately.

Properly designed courseware can often be delivered in less time than traditional teaching methods, with students training when the equipment is available, even if the teacher is not. Another advantage to this type of instruction is that it provides all students with the material equally, regardless of when they access it, but this does not take into account

whether all students comprehend the same material. When teachers are presenting information verbally, they do not always say the same thing every time, nor do different teachers necessarily present identical material (91-100).

Evaluating

Once the program is implemented, it is important to go back and evaluate the application before releasing it for general use. Marshall suggests the authors address these issues (152-153):

- Is the application the right tool to communicate the information?
- Is the information presented actually correct?
- Are the advantages of the computer used to the fullest?
- Is it truly user centred and in the user's control?
- Is the documentation clear and adequate?
- Is there flexibility in the application?

Effective Courseware Principles

Once it has been established that IMMI is the most effective way to present the educational material, the designing of the courseware and the writing of the text begins. The linguistic aspects are not the only issues to be considered. Yeow-Chin Yong points out four other problem areas the development team must consider (82 -85).

Human - machine interaction

Unfortunately, many applications have too many key commands to learn and too much text in instructions. However, menu-driven lessons enable students to quickly see what they have input and the computer reacts with suitable remarks.

Learner control of the learning process

Students should be able to go at their own pace, see previous work and, wherever possible, provide flexible answers. Reactions will be more positive if they are allowed three attempts at answering questions (with hints) and given test scores and achievement ratings along the way.

Organization of the material

Choices of teaching style, presentation mode and the time each lesson takes differ from traditional methods of courseware development. Another important aspect to keep in mind is the limitations of the authoring tool. This last factor will be discussed further on in this chapter.

Design of the graphic displays

Depending on the material being presented, images can capture the learners' attention and help them to understand. The specifics of the graphic representation of information are dealt with in detail in chapter 5.

Linguistic Aspects

At this point, very little research and study has been done regarding the effectiveness of course material specifically written for viewing on the screen. Most literature assumes that the research on print-based material can be applied to screen-based information. "However, it may not be safe to abstract screen-based guidelines from print-based studies. Indeed there is some reason to believe that such generalizations may not be safely made, at least with respect to some characteristics", report Schwier and Misanchuk (210).

Writing text that is to be viewed on the computer screen requires a different format than text book writing. Advances in technology mean we no longer need to view words on dark screens with amber or green light, but it is still more difficult to read from the screen than on paper. Therefore, the format must facilitate screen text reading.

Issues such as reading speed, comprehension, retention, and learner preferences need to be studied and researched for screen-based learning as they have been in the past for print-based learning.

Simple Guidelines

There are a number of simple guidelines to help the writer communicate information designed to be read on the screen. Soulier (82 - 90) and Schwier and Misanchuk (214 - 215) suggest

- Use the active voice: it is simpler and more direct
- Write in the language level appropriate for the intended user
- Use statements in a positive form, especially feedback
- Remember that users who do not understand computer jargon are distracted by it
- Use point form if possible
- Use personal pronouns in an informal language (contractions are acceptable)
- Use inclusive language (references to gender and race)

Segmentation is the breaking up of sentences into chunks that are meaningful thought units.

As Soulier writes, " … keep foremost in your mind that you are writing to communicate with another human being … even though it is the computer that is doing the communicating" (83). He goes on to recommend that the program be tested on users who have less than the anticipated background of the intended learners.

Some research has been conducted in the area of writing for the screen using segmentation – the appearance of "chunks" of information. While Frase and Schwartz determined that response times to segmented text was 14% to 18% faster than typical presentations of text (197), others such as Morrison, Ross, Schultz, and O'Dell found no clear evidence of the advantage of chunking (53). Their research methods and their results vary too much to provide any definitive conclusion at this point therefore the issue needs further study.

Soulier quotes an anonymous author to illustrate satirically, the basic principle of writing text for the audience: "Mary was the legal owner of a diminutive potential sheep, whose haliberments were as innocent of coloring as congealed atmospheric vapor" is not necessarily the best way to say, "Mary had a little lamb and its fleece was white as snow" (115).

Illustration 2.1

normal linear text	branching text	networked text
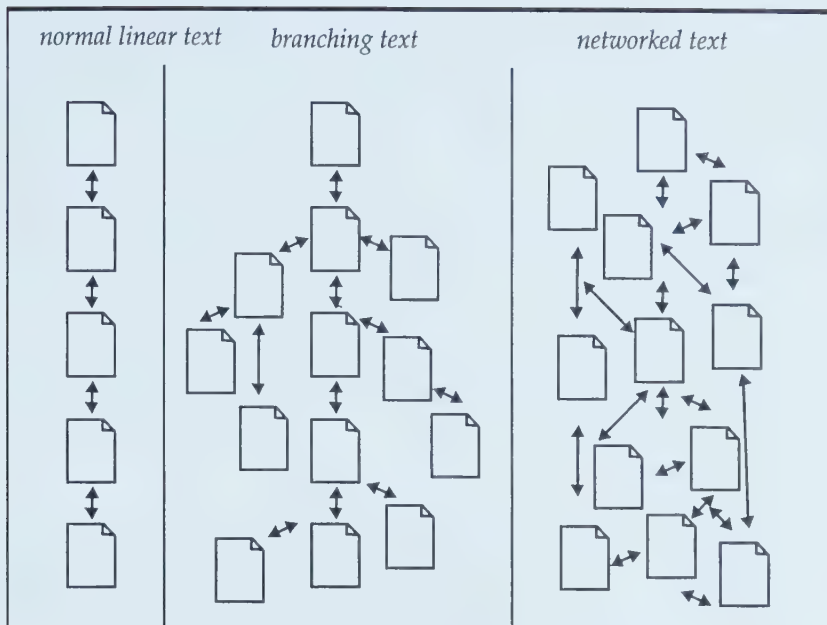
Hypertext

Hypertext uses nonsequential writing: text that branches into different directions, depending on the choices the reader makes. A word or image is active, meaning that if the learners select a specific item, they are sent to another file pertaining to that subject. Used in IMMI, hypertext files or blocks of information link to one another, allowing for multi-layering and networking. While Booth describes hypertext as unlike normal text which is passive and linear, he concludes that there is still a place for printed material, especially in the presentation of large amounts of text. The fact remains that people still find it easier to read from paper. "Hypertext is not a replacement for writing skills, it can only augment well-written documentation, it cannot make bad text easier to understand" (221).

Hypertext uses nodes that are relatively self-contained so users can view each node independently.

*Hypemedia uses media such as audio or video within the nodes.*

Designing and writing hypertext documents and learning resources resemble other IMMI applications, but additional guidelines must be considered. Steven Staninger agrees that hypertext, like other writing for the screen, must be written for its specific audience and be user centred. Hypertext differs in that it must also give a choice of access points and show the learners where they are in the network. It is too easy to get lost because there is often no clear starting point (52-53).

As design strategies, hypertext and hypermedia can be more expensive to create and have compatibility problems with various software but according to Chin-lung Wei, "Hypertext is more effective at promoting acquisition of non-linear thinking" (52).

Learners using hypertext will need to adjust to this non-linear way of accessing information, while still reacting to all of the required objectives in a given lesson. This complexity poses a challenge for the designers of hypertext based teaching: learners, while being given a variety of paths to follow, still have to learn a specific block of information. A properly designed hypermedia document allows for exploration while still providing the user with the required information (Wei 52-53).

Illustration 2.2
Hypertext
linking nodes

linking nodes
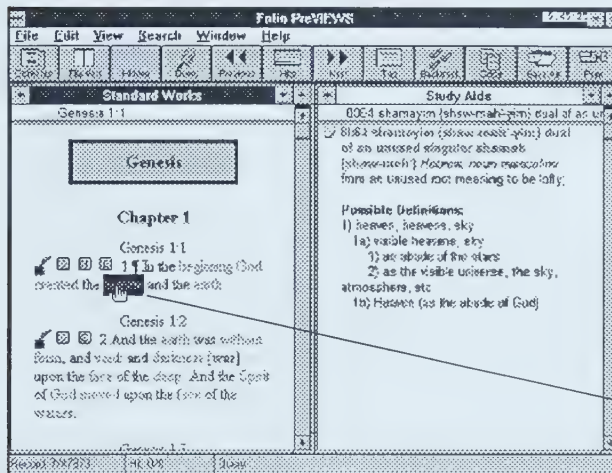
Authoring Tools

No authoring tool can be all things to a design team. Each has its drawbacks, specialities and a specific focus based on the original functions its designers gave it. When choosing an authoring program, many things must be considered:

- Learning objectives of the application
- Knowledge level of programmer, designer or educator
- Required complexity of the application (linear or non-linear)
- Budget and time constraints
- The hardware and software that is currently available in the existing environment

• Audiovisual technology requirements such as sound, animation, digital images and movies, or videodisc interaction requirements

In most cases, the design team will require a combination of software products to create their application. What they chose will vary because programs change, are upgraded and there are new packages continuously being released. A survey is included in this thesis in Appendix B. It is meant as a short overview of some of the currently available authoring tools and additional software required in creating interactive multimedia instructional programs.

It is important to remember that the experience and skill brought to these programs by the educator or the design team will determine the quality of the end product.

Chapter 3 – General Design Parameters

Orientation and Navigation

If the orientation and navigation design of an IMMI application does not help the learners, or if it actually hinders them, then the required learning cannot take place. Questions such as: where am I?, where can I go next? and how much have I completed? and how much more is there to do before I finish?, are all issues to be addressed in designing the system (Schwier and Misanchuk 224).

Schwier writes that page numbers are both for orientation and navigation. While the action may not be as easy as it is for a book, IMMI learners must be able to "flip" through a program, going back and forth at will. However, it is also very important that at times a learner should not be able to go forward without having first finished or reviewed certain material.

Navigation devices can vary from pull-down menus to click-on icons. As long as clear instructions are given early in the program and the system remains consistent, the navigation devices do not have to be placed in any specific section of the screen (224-225).

Metaphors

The use of a metaphor must be appropriate for the subject matter. A serious subject such as educating about child abuse should not be treated in a 'cute' manner. The desktop metaphor currently used in most computer environments assumes that the majority of users are experienced in working in a print-based medium. Therefore, items such as file folders, trash cans and the desktop are used as images to represent ways of dealing with electronic data. These signs may not be appropriate for young learners in the future and designers must take such changes into account when deciding what navigational metaphors to use.

The navigation system is an organized structure required within the non-linear space of the program. While some systems need not be elaborate, complex information such as complicated networks require expertise in information design (Grimes 3).

Illustration 3.3

A metaphor is the indirect comparison of two objects.

Idea =

Delete =

Wait =
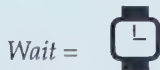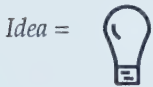
Icons, maps, diagrams and pictures are employed in navigation, helping learners access information quickly. Readers of books require a sense of where they are within the whole structure. Multimedia, makes gaining that same sense more difficult.

Redundancy

It is best to make it easy to browse through the application so learners don't have to guess what to do next. They need to feel that they are in control and they want to know both the degree and nature of their control. This includes how to stop, how to repeat, how to get help and how to move on (Schwier and Misanchuk 227-229).

John Grimes emphasizes redundancy as a key issue in navigation design. "In practical terms, navigation requires redundancy. Navigational information needs to appear in multiple forms and in multiple places. Controls need to provide immediate feedback, visually, sonically, kinesthetically". He continues to explain that when learners are in "unfamiliar environments," redundancy is required to effectively get the message across (4).

Critical to navigation design is knowing the age and experience level of the learner: this determines the level of redundancy. But whether the audience are first-time users or not, the consistency from screen to screen must be emphasized. Images, graphic clues and other navigation tools should not change in style from one screen to another.

Delivery of Content

Another area of possible future research in navigation and orientation design is the possibility of changing how the information is presented to the learner, based on the learner's preferred method of acquiring knowledge. Some people learn best in a linear fashion, others in a non-linear one. "Just as the readers of books, contrary to the implicit concept of books, can skip chapters, jump to the end, or just look at the pictures, the audience for multimedia must be allowed these and greater freedoms, including the freedom to completely reorder the content and/or the method of delivery" (Grimes 5).

Screen Display

In a recent edition of the *Halifax Mail Star*, in an article about the use of computers and computer-aided instruction in the classroom, Rosemarie Shannon, producer of the I-Learn programs from Sanctuary Woods Multimedia Corporation is quoted as saying, "[IMMI] is designed to be a supplement, there are still a lot of things that should be done in book format" (B7). As in other visual communications, the authors and designers must consider in what form the information will be conveyed, and there are times when newest is not always best.

Elizabeth Boling contrasts the interactivity of the printed page to that of the computer screen. She notes that while reading print, readers can skim pages, reread some passages while skipping others, go to indexes and turn back at will. But the book also remains static, no matter what the reader does. Whereas in screen reading, users can still skim, skip, 'turn pages', but they can also go to other relevant parts easily (13).

Soulier suggests educators remember that IMMI lessons are often presented without the teacher and therefore the display should contain all the information to complete that screen's task. "The dictionary defines pedagogy as the 'science or art of teaching'. The process of [screen display] design is both a science and an art. The principles and methods used in [screen display] design must be derived from a solid research background in proven teaching/learning practices and from a sense of intuition and anticipation into what will work best in a given situation." (114). Though his research is based on reading text on a screen that is capable of only a fixed number of characters per line, he recognizes that a hardcopy of the written text should be supplied when more text is necessary (115).

Grid and Layout

A grid is the invisible structure used for consistent placement of certain items. Frank Maddix argues that while navigation and orientation items should remain constant, varying some elements such as number of columns, image and text placement within a grid can alleviate boredom.
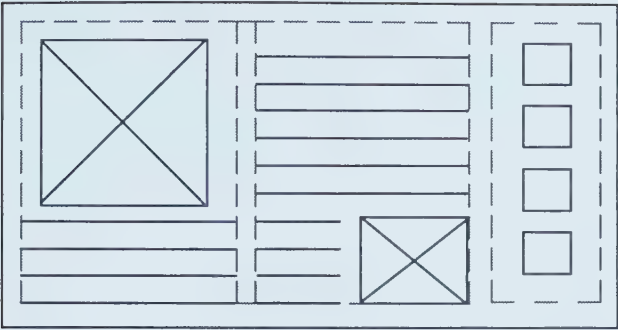
Illustration 3.4 example of grid layout

If the layout within a grid does not follow good design principles, the display can still be boring. Designers should follow basic design principles similar to print-based layouts in order to create a consistency in the application (249).

While Schwier and Misanchuk believe instruction considerations must come first, followed by aesthethic guidelines (215-221), I believe both must always be considered. Consistency can be achieved through balance, harmony and unity on the screen.
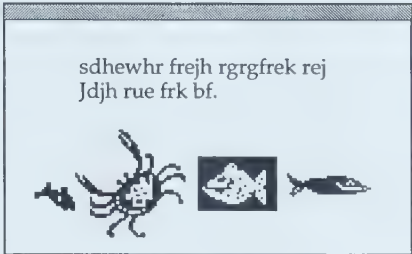
Balance

On the screen, the placement of all texts and images appear stable. Symmetrical balancing often appears more formal and sometimes less exciting than an asymmercial format.

Illustration 3.5a left: example of bad balance
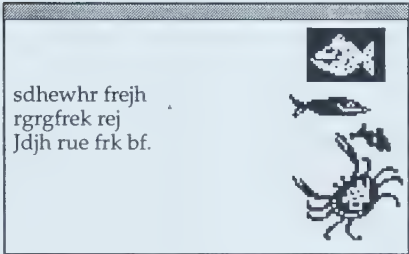
Illustration 3.5b right: example of good balance

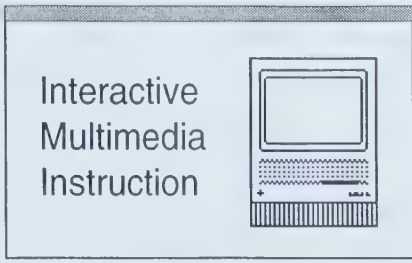## Harmony

Choosing images, text, colours, and even sounds that are consistent in style creates harmony. For example, if the choice of fonts (lettering) is incompatible with the image – for instance an old fashioned title and a modern computer, then harmony isn't achieved.

Illustration 3.6a left: example of bad harmony
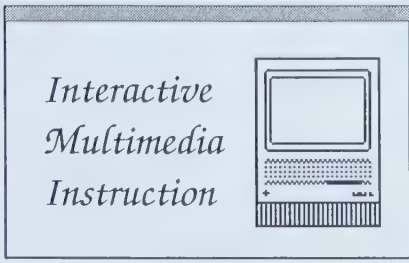
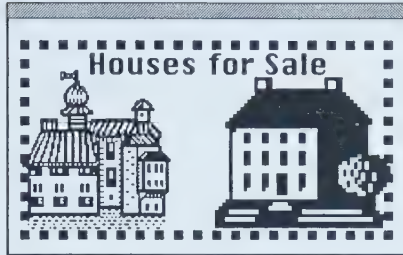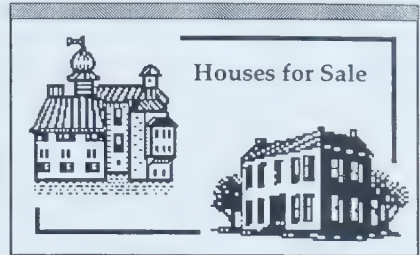*Illustration 3.6b right: example of good harmony*

Unity

Images that fit together in size and style create a wholeness that becomes the focal point where the various elements do not compete for attention.

White Space

In ancient Egypt, scribes used every bit of space on the writing surface because of the expense in both time and material. This attitude transferred over to the printed page and unfortunately to the screen. The screen's blank space however, is essentially "free" compared to a paper's white space, and larger amounts of it do not increase production costs of IMMI material.

Soulier reports that when considering what white space is on the screen, we must remember that first of all it is not necessarily white, but it is the space not devoted to text or graphics (and is not merely the leftovers). White space brings together or separates ideas and can create lightness, making the information less overpowering to the learner.

"When the eye and mind can't find that resting point within a [screen], the eye goes elsewhere, and the mind wanders away from the computer lesson. Some research suggests that, for this and other reasons, as much as 50 percent of a [screen] should be blank space. This includes margins, space between lines of text, space between letters and words, and space within illustrations" (191).
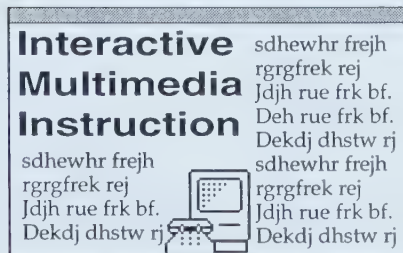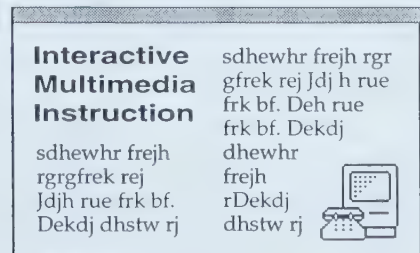
White space is also used to organize information in a hierarchical form, making it easier to quickly grasp what the subject matter is (through headlines) and where the important information lies.

Menu Design

Good menu design can "eliminate training and memorization of complex command sequences" (Shneiderman, 98). This is especially important when the application is used intermittently by the learner making it difficult to remember complex commands. Single keystrokes or single mouse clicks also simplify the task and help in the user's decision making process.

Ben Shneiderman comments, "The primary goal for menu designers is to create a sensible, comprehensible, memorable, and convenient semantic organization relevant to the user's tasks" (99). He believes menu designers should take note of the way books are divided into chapters, animals into species, and catalogues into sections when deciding how to structure menus. Categories should be simple and should make the learner's task selection easier.

Illustrations 3.9a

- *binary menus (cancel/okay)*

- *multiple menus (radio button)*

- *extended menus (scroll bars)*

- *multiple selection menus (check boxes)*
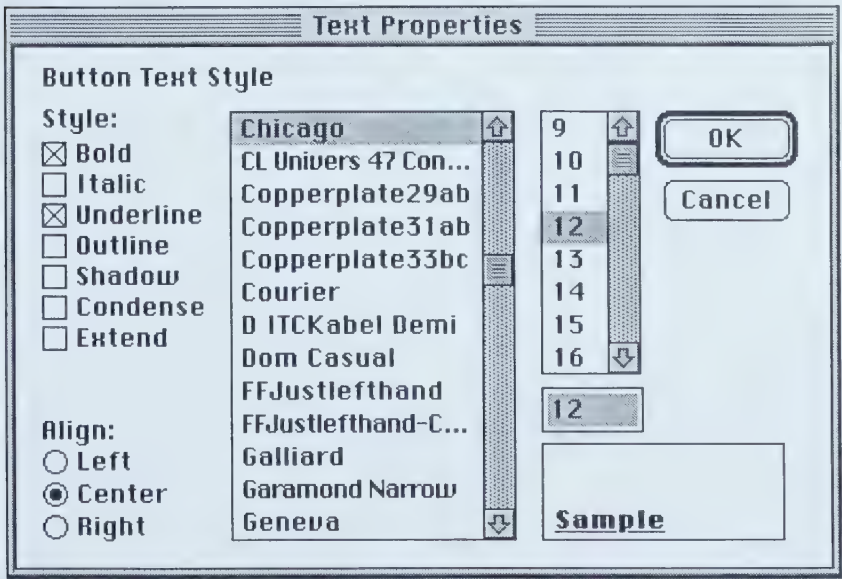
Text Properties

Button Text Style

Style:
- ☒ Bold
- ☐ Italic
- ☒ Underline
- ☐ Outline
- ☐ Shadow
- ☐ Condense
- ☐ Extend

Align:
- ○ Left
- ● Center
- ○ Right

Chicago	9	OK
CL Univers 47 Con...	10	Cancel
Copperplate29ab	11	
Copperplate31ab	12	
Copperplate33bc	13	
Courier	14	
D ITCKabel Demi	15	
Dom Casual	16	
FFJustlefthand		
FFJustlefthand-C...	12	
Galliard		
Garamond Narrow		
Geneva		Sample

Paint	Options	Patterns	Color		LaserWriter 8 Page Setup

Paper: US Letter ▾

Layout: 1 Up ▾

Reduce or Enlarge: 100 %

Orientation:

| ^G Get Help | ^X Send | ^R Read File | ^Y Prev Pg | ^K Cut Text | ^O Postpone |
| ^C Cancel | ^J Justify | ^W Where is | ^V Next Pg | ^U UnCut Text | ^T To Spell |
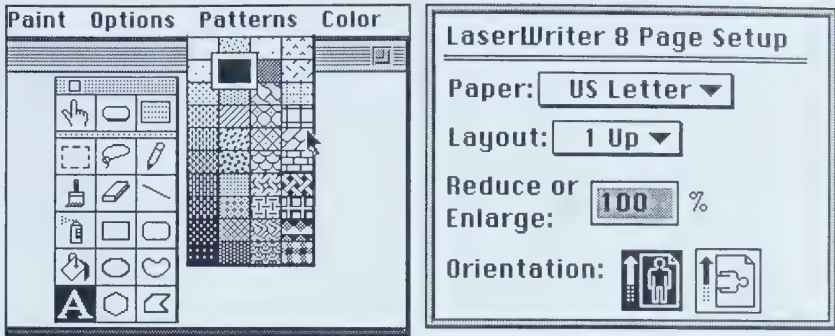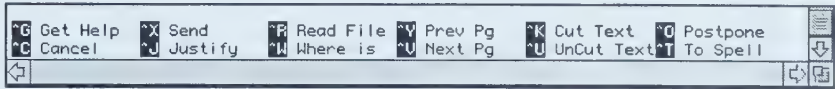
In menu design, a critical variable is speed, in both the display rate and the response time. The computer must react quickly to the learner's choice.

Very little research has been done on menu design. Modern screens, with their variable letter spacing capabilities create particular design challenges that should be explored. Shneiderman grants that his guidelines are " ... distilled from practice, but that [they] still require validation and clarification." (121):

He suggests:
- Organizing menus according to task
- Using graphics, numbers, or titles to show position
- Sequencing or grouping items in a meaningful way
- Using keywords, being brief
- Maintaining consistency with language
- Allowing jumps to previous and main menus

Finally, it is important to remember that both display rate and screen size should influence what type of menu the designer creates. Display rates refer to the amount of time it takes for the computer to show an item on the screen.

Colour

Authors of the majority of the literature surveyed for this thesis assume that the colours available are 'pure' monitor colours. This is largely due to the fact that most books written about screen display were written a number of years ago, when the technology was not as advanced. Up until recently, a colour monitor of a CRT screen could display only eight colours. The cathode ray tubes (CRT) shot a burst of red, blue and green

Illustration 3.10 additive colour wheel

(RGB) light through the screen, either one, two or all three at a time, to produce seven colours. The absence of light resulted in black and all three created white.

Most research refers to these 100% saturated colours as the only colour options, with some colours creating a halo effect on the screen. Today, the limitation is no longer true. With most colour monitors capable of displaying either 256, 1026 or millions of colours, saying that blue shouldn't be seen with red is absurd. Which red, which blue?

Colour selection

The following considerations for the selection and use of colour were developed by Shneiderman (338-342).

- Limit the number of colours used for menus and text
  (some suggest a limit of 7, more for experienced users)
- Use colours as coding techniques
  (example: display of incorrect answers in red)
- Be consistent throughout the application
- Be alert to common expectations
  (red for stop, blue for water)
- Be aware of colour pairing problems
  (when there is not enough contrast)
- Use colour changes for status changes in information
- Be aware that screen resolution and display of colours can vary with each monitor

Colour blindness

Another design consideration takes into account colour blindness. Floris van Nes reports "About 8% of the male population is to a greater or lesser extent colour-blind: for these readers a sufficiently high luminance contrast between letters and background must be provided whenever colour is used which they may have difficulty in distinguishing. Although they perhaps will not see the colours as different, they may still be able to read the text thanks to the difference in luminance between text and background" (19). The most common manifestation of colour blindness occurs between red and green. For graphs and some illustrations, textures, along with colour and luminance contrast, can also be used to help distinguish areas instead of colour.

Icons

Illustrations 3.11 standard icons
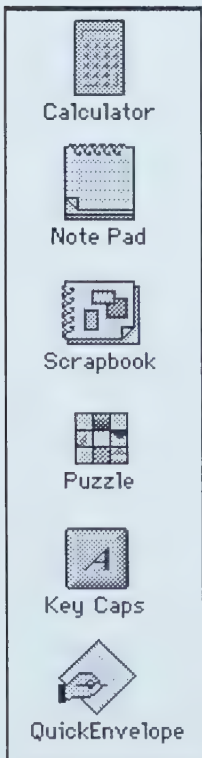
Icons allow for easier recognition of information and can often represent ideas better than text can. They are more memorable and have a more immediate impact which allows for increasingly rapid decisions to be made. Creating the icons requires that the designer know the audience well in terms of user sophistication and background, and in some cases, even cultural background. What the icons represent can change over time, or with the experience of individual groups. Icons must change and adapt according to the environment in which they are used. They are usually analogies that are stretched to fit into a new context, such as using a trash can icon as means of deleting a file (Maddix 154-157).

Although good icons are intuitive, whenever a new icon is introduced, the user must learn how to interpret it. A word is sometimes much more efficient in communicating an idea than an icon. For instance, 'Quit' might be easier and quicker to grasp than a symbol.

The decision of whether to include a key word with the icon must be based on who the audience is and whether they are frequent users. In some applications, learners may have the option of removing the label but for most situations they should remain. There is also the danger of falling into the trap of iconizing everything to the point where icons become difficult to distinguish from one another.

Calculator

Note Pad

Scrapbook

Puzzle

Key Caps

QuickEnvelope

Chapter 4 — Screen text attributes

Readability Issues

Reading text on the screen is not the same as reading the printed form. Dillon *et al* report that reading text on the screen: can be up to 30% slower than reading from paper, be more tiring, and be responsible for more errors. Many users also rated reading from the screen as inferior. The researchers attribute these findings to a number of factors (456-464):

- The orientation of the screen (people are used to vertical not horizontal 'pages')
- The visual angle and distance used to view the screen (much farther than from eye to book)
- Whether the users were familiar with reading on the screen or not
- The dynamic aspects such as screen filling, refresh rates, illumination of the screen and flicker
- The halo effect sometimes caused by anti-aliasing
- Choice of display characteristics (font size, leading etc.)
- Contrast between foreground and background colours

Illustration 4.12

regular text

Anti aliased text
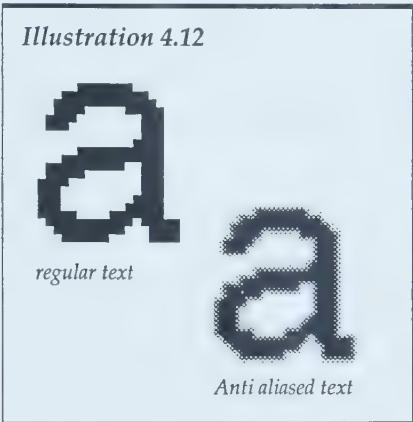
Font Selection

In print-based material, font selection was often based on appropriateness first, with legibility or readability a close second. This was partially due to the fact that the resolution of the letterform was high in typesetting with no need to consider the drawback of the pixels on a screen and their various resolutions.

Chicago

bitmapped

Font options on the screen come from a variety of sources. **Bitmap** fonts consist of a collection of square

bits similar to a mosaic that create a letterform. The resolution is usually much coarser than any other type. Apple Macintosh issues a number of fonts in bitmap form; they are recognizable by their city names: Chicago, Geneva, Monaco and New York. Though inexpensive, they are coarse, unrefined and should be avoided. They were originally designed to work well on the Apple Imagewriter, a dot matrix printer. There are programs such as Adobe Type Manager that will smooth out the look of the text on the screen. Unfortunately, if you use a 'smoothed' font, it will not necessarily appear smooth on the classroom computers unless they also have the same software.

Laserwriter fonts are now available on most computer systems. The quality of the type on the screen will sometimes be affected by the size

Helvetica
laserwriter font

chosen. Examples include: Avant Garde, Bookman, Helvetica, Palatino and Times. These fonts are resident in the computer and therefore do not require purchasing or separate licensing agreements for use in IMMI applications.

Postscript fonts that are purchased are of high quality and come in a variety of styles. IMMI developers using these fonts must include them when distributing their application. This requires that they pay a licensing

Stone Sans
postscript font

fee for each copy of the application, so that copyright laws are obeyed. While the fonts may be better, in most situations, this is not a viable option due to the added expense.

Anatomy of type
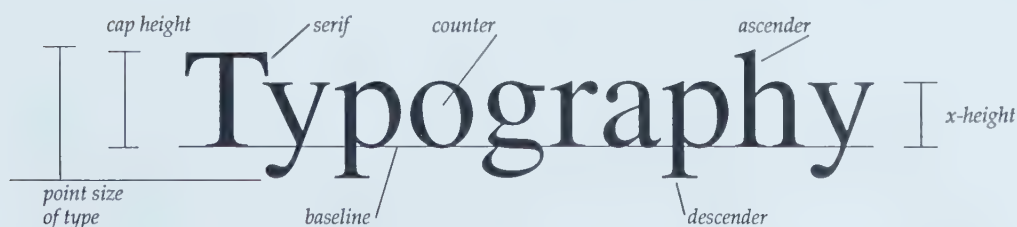
Illustration 4.13 basic vocabulary in identifying type

Illustration 4.14 *Other considerations which affect the choice of fonts*

10 point type • **Size**

14 point type

18 point type   Size is measured in points. There are 12 points in a pica and approximately 6 picas in an inch (the computer rounds it up to an even 6)

Times has a low x-height • **X-height**

Helvetica - high x-height   X-heights vary depending on the typeface

Regular • **Weight**

Bold   The width of the letterform depends on the lightness or heaviness of the stroke

Condensed • **Width**

Expanded   The horizontal measure of the letterform

Italic • **Slant**

Letterforms that are straight up and down are called roman, slanted are called italic

Underlined • **Style**

Strikethrough

Outline   Style pertains to the special effects of a letterform. Caution must be used when applying them

Shadow

All UPPER CASE TEXT IS HARD • **Case**

TO READ IN LONG STRINGS

• **Blinking/flashing**

These effects should be used for short messages of short durations only

• **Colour**

Coloured text should be used carefully. It works best for large type and contrast is important

Serif versus Sans Serif

The extrusions or 'feet' that some typefaces have are called serifs. While there is no empirical evidence that serif as opposed to sans serif type is

better, Soulier believes, "The added lines of the serif style increase the readability of text displays and make the letters more interesting to the eye" (197).

There is no 'magic' answer as to which is the most appropriate font to use in a project. Questions of subject matter, audience, equipment used for display of the application, and the parameters of the learning situation will all affect the choice of appropriate font. Amount of white space, the variety of type sizes (not fonts), and basic layout guides will also determine whether a font is effective.

Line lengths

The line length should be dictated by content and type size, and not by the margins of the screen, (as was often the case for the printed page). Consequently, line lengths should end according to content and reading patterns, and not margins (Schwier and Misanchuk 231-232).

In print-based media, the "rule of thumb" can vary from averaging 35 up to 75 characters per line, depending on the source consulted. Researchers generally agree that readers do not like line lengths that are either too long or too short. Tinker concluded that determining optical line length must include considering the font and leading (147). I found no empirical research on the optimum line lengths for screen design. As an unfortunate consequence, the old rules of print-based line lengths are often quoted in determining screen text line lengths, without considering the new medium.

Illustration 4.15   *Short, desirable and long line lengths*

"The purpose of interactive multimedia instruction is not to dazzle, to impress, to amaze, or to delight, but to communicate."

"The purpose of interactive multimedia instruction is not to dazzle, to impress, to amaze, or to delight, but to communicate."

(the length of the average word will effect optimum line lengths as well)

"The purpose of interactive multimedia instruction is not to dazzle, to impress, to amaze, or to delight, but to communicate."

Leading

Leading (rhymes with heading) is sometimes called interlinear space. Macarena Aspillaga confirms that the reasons for using adequate leading are the same for screen-based as for print-based material. Extra line space can result in a more perceptive word shape if correctly applied. If there is too much space however, it is more difficult to follow the thought or idea as a continuous sentence. Proper leading can also help establish hierarchy in the text (54-55).

Illustration 4.16 *Leading*

11/12

"The purpose of interactive multimedia instruction is not to dazzle, to impress, to amaze, or to delight, but to communicate."

11/14

"The purpose of interactive multimedia instruction is not to dazzle, to impress, to amaze, or to delight, but to communicate."

11/18

"The purpose of interactive multimedia instruction is not to dazzle, to impress, to amaze, or to delight, but to communicate."

Word Shapes

The right leading is a balance of enough leading to perceive word shapes.

But if there is too much leading, it is more difficult to follow a continuous sentence.

Alignment

Alignment refers to the shape the block of text will make on the screen. While fully justified text is often used in text books, flush left is preferred to facilitate proper segmentation of text, and to avoid awkward hyphenation, letterspacing and word spacing.

Illustration 4.17 *Alignment*

Justified

"The purpose of interactive multimedia instruction is not to dazzle, to impress, to amaze, or to delight, but to communicate."

Flush Left

"The purpose of interactive multimedia instruction is not to dazzle, to impress, to amaze, or to delight, but to communicate."

General Guidelines

While researching the topic of text design, I came across a study for the United Kingdom Royal Nation Institute for the Blind. The majority of the basic rules that apply to print-based material for the visually impaired can be applied directly to screen display type (Bruce *et al* 23):

- Emphasize contrast between type and background
- Type sizes recommended are 14 or 16 point
- Avoid light type weights, especially in small sizes
- Avoid bizarre or indistinct typefaces (numbers like 3, 5,8, can be a problem)
- Avoid long strings of capital letters (UPPER case) since they are harder to read
- Use shorter than average line length and avoid hyphenation
- Keep to regular, not stretched or condensed, lines of type
- Avoid justified typesetting
- Use a line space between paragraph

When educators with little design experience are designing their own IMMI applications, they should adhere to the KIS theory. Keeping it simple, using a grid and readable fonts, will go a long way in communicating information.

Chapter 5 – Presentation of Images and Audio

Interactive multimedia instruction implies not just the use of text but also images, and possibly motion pictures and sound, combined in learning resources. Ok-choon Park writes, "When the concept and tasks are encoded in both verbal and visual forms, they will be retained in memory longer and will be more easily accessed than when they are encoded in a single form, because the two types of information in memory complement each other in the activation representation, and development of related information or concepts" (21). Learners have a better chance of remembering information that is presented in both text and image form, if the two work well together. When deciding what images to include in an IMMI application, the designer must consider whether they will facilitate learning or distract the user.

Illustration Guidelines

Illustrations 5.18

Would the target audience understand these symbols?
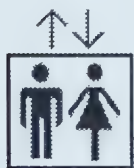
When used properly, illustrations will enhance and promote learning. The basic layout should be a guide as to where the images will be placed, but there are other considerations as well.

- The image size should not overpower the screen, nor be so small that the user cannot analyse it
- Illustrations and graphics should be appropriate to the audience
- Simple line drawings should be used if complex learning of information is to take place otherwise the learner can be even more confused
- Preloaded illustrations save on waiting time
- Good standard symbols should be used, making sure that the audience understands them
- When using colour coding, a backup pattern must be provided
- Animations should be short and appropriate
- Avoid providing too many images on a single page. It can be confusing and difficult to retain in memory
- Place an illustration as close as possible to its related text (never on the preceding page), to avoid obscuring the connection

Illustration 5.19 *medical illustrations need high definition.*
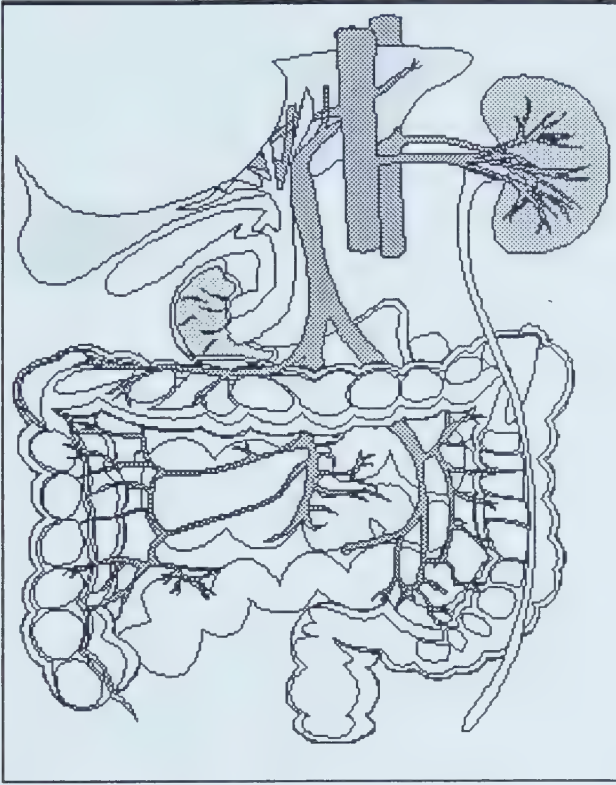
It is important to remember, that the screen is not always the most appropriate medium, or the only alternative for providing information to the learner. Background material in hard copy form may be at times necessary, especially if complex images must be memorized (Soulier 204-205).

It is important to consider the quality of the display. Using a screen with poor resolution when fine details are required, is not better than using a hardcopy. Verbal explanations of the illustrated information must be provided and at the level appropriate to the intended audience (Park 22-24).

Other Visual Elements

Rules

Also referred to as lines, rules are measured in points and can emphasize and help organize information.

Shapes

The guidelines for the use of graphic elements such as the shape of boxes, are complex and cannot be covered properly in this thesis. In Appendix A, I have listed a number of excellent references that, while meant for print-based material, provide information relevant to the creation of IMMI.

Dynamic Visual Displays

The term dynamic visual display (DVD) refers to the use of pictorial or graphic motion in IMMI applications. Such displays can take the form of motion pictures, or animation and function as an attention guide, to highlight critical features, or explain sequences of events.

For example, DVDs can be used to demonstrate the repair of equipment or show an action that is hard to explain verbally or difficult to percieve in only still pictures. They can also illustrate information that can not be filmed clearly, such as blood flow in the body.

Illustration 5.20
complex demonstrations are better displayed with DVDs.
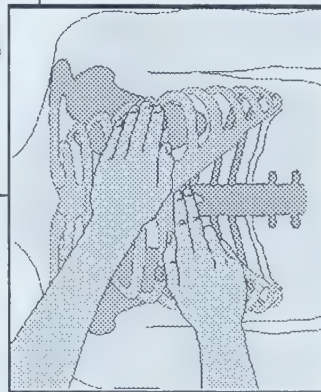
Audio Considerations

Sound should never be used as simply an additional medium to the multimedia part of the presentation. Consider what kind of material is being presented, and whether it requires the addition of sound. Applications about music, dance, foreign languages and animal communications would all benefit from an audio component. However Boling suggests that sound is not always appropriate, "Consider your audience. Will they absorb your material more effectively if it's spoken out loud than they will if they have to read it? Will they be distracted or annoyed by a voice coming from the computer?" (16). For example, the

reminder sound or beep of turning a page may be required for young, first time users of IMMI, but it may be redundant to other users and absolutely annoying to older, advanced users.

The quality of the sound must be at a high enough level for it to be effective. Background music or alarm sounds will not need to be as defined as a voice. High quality sound requires large amounts of memory, requiring bigger and faster machines. Sounds should also be positive and not annoying, especially if the learner is in an environment where others might hear the sounds. Being chastised for a mistake is not the best way to encourage learning!

If sounds are helpful, but not critical, then the user should have the option of turning the sound off. This is especially useful in frequently used programs, where the user's level of sophistication increases with every use.

Chapter 6 – Case Study 1: Math30

Introduction

With traditional print-based material, designers needed to start with some basic questions before deciding the format their design would take. Items like budgets, target audiences and delivery limitations had to be discussed. These considerations still hold true for IMMI factors with added questions of not simply who the target audience is, but what kind of equipment they are most likely to have. Most marketed programs are not necessarily developed for the current equipment in schools, but rather for future technological capabilities. The hardware and software may be available for developers but school systems usually take longer to acquire newer, faster equipment.

> **Events of Instruction**
> - Gain learner attention
> - State objective
> - Recall prerequisites
> - Present information
> - Provide learning guidance
> - Elicit expected performance
> - Provide feedback
> - Assess performance
> - Enhance retention

Gagné and Briggs identified the principles for instructional design through their "events of instruction" (166). They give a clear reference for evaluating an IMMI application.

While many of the extensive IMMI applications developed today are pedagogically sound, there are pitfalls to consider when deciding to implement them. They take a tremendous amount of time, effort and expense. They must match the learning requirements of users or they will fail. And lastly, sometimes when they are used extensively, they can be repetitious and thus boring (Sweeter 49-51).

Analysis of the project

Originally developed as an alternative way of teaching the Province of Alberta's grade 12 math curriculum, the CD-ROM version of Math30 is now being used in over 1000 schools throughout the world. Dr. Milt Petruk of the Educational Technology Division in the Faculty of Education

at the University of Alberta developed the course through the Alberta Distance Learning Centre. Authorware was chosen as the most appropriate authoring tool because of its testing management capabilities and the advantage of being cross-platform (Macintosh and DOS)
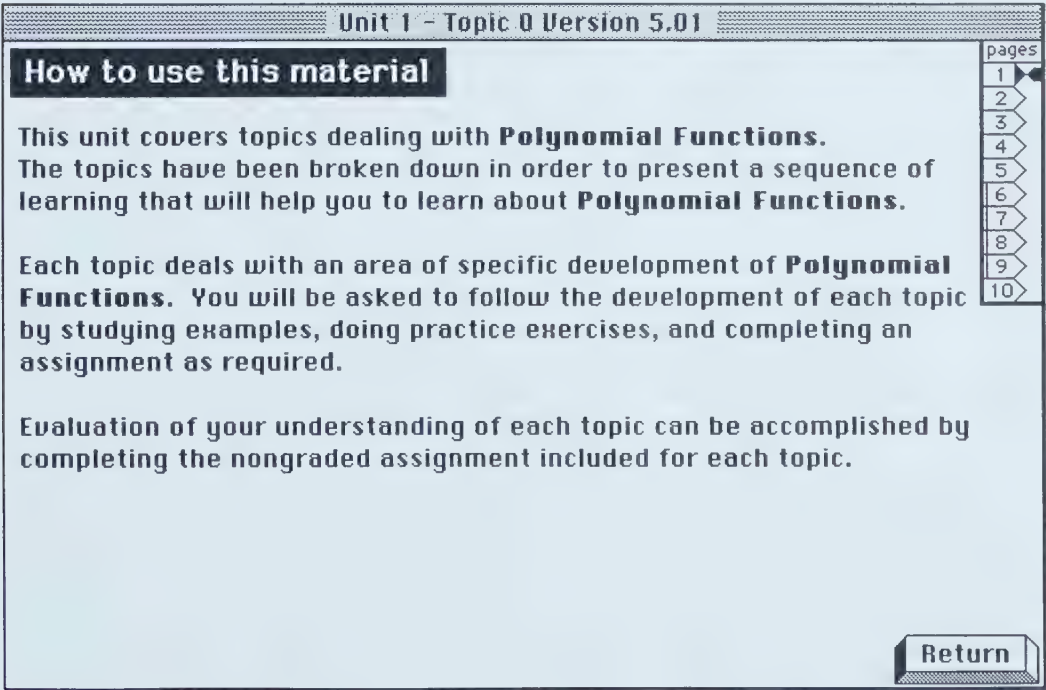
Audience

Audiences include not only distance learners, but students who work individually on computers with the teacher serving as a trouble shooter as well as educators using large monitors to display the screens as learning resources. Because it is assumed that all students using the program are computer literate, the course begins with minimal instruction. There is, however, a 'ReadMe' file on the CD-ROM which explains the basics.

Design Issues

Math30 is divided into seven objectives in the area of polynomial functions. Units consist of overviews, examples and practice. There is an extensive testing bank included as well.

Illustration 6.21 one of the original Math30 screen

Intended for a black & white 9" Macintosh monitor, Math30 was originally designed by Dr. Petruk and a team of educators and programmers. They have decided to release a new version, redesigning the interface to

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Unit 1 – Topic 0 Version 5.01

pages
1 2 3 4 5 6 7 8 9 10

How to use this material

This unit covers topics dealing with **Polynomial Functions.**
The topics have been broken down in order to present a sequence of learning that will help you to learn about **Polynomial Functions.**

Each topic deals with an area of specific development of **Polynomial Functions.** You will be asked to follow the development of each topic by studying examples, doing practice exercises, and completing an assignment as required.

Evaluation of your understanding of each topic can be accomplished by completing the nongraded assignment included for each topic.

Return

accommodate the use of a 14 inch colour monitor. The content will remain the same. Other restrictions included limited colour display and amounts of colour because excessive use of colour slows down the processing speed significantly. Font choices are to be limited to either bitmap Macintosh fonts (as previously used) or resident laserwriter fonts to avoid licensing costs.

Icon Development

Existing Icons

Illustrations 6.22 A series of icons were developed specifically for the print version of the distance learning package. Not only were the majority of these inappropriate for the computer version, but the icons actually represented something totally different in the environment of the desktop metaphor most computer systems use.
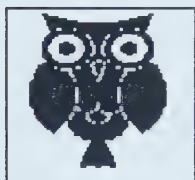
what you already know The black and white version of Math30 uses a majority of the print icons as well as new ones developed by a variety of programmers, all inconsistent in size and meaning.

introduction icon

key ideas icon

concepts icon 1

concepts icon 2

practice icon

overview icon

example icon
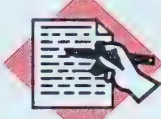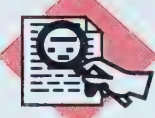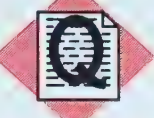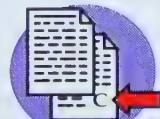
Icon Revisions

The redesigned colour version is still in the testing stage, with an expected release date in the Fall of 1995.

Dividing each simple section into either action or statements, an icon system was developed using colour and shape codes. A pictorial icon was then created.

Illustration 6.23 New Icons

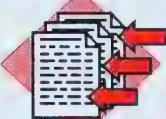| Process	Icon and shape code		
Simple Actions	Extra Help	Further Study	
Complex Actions	Activity	Extensions	Practice
	Exploring	Questions	Examples
Simple Statements	Concepts	Key Ideas	Introduction
	Objectives	Solutions	
Complex Statements	Overviews	Reviews	What You Have Learned
	Previews	Conclusion	

The icons were created in Aldus Freehand 3.11 and exported as Pict2 documents in order to place them into Authorware.

Layout Revisions

Standards:

The grid consists of either 2 columns or one centered column, depending on the amount of text required for each screen.

The type face, Palatino was chosen because it is a laserwriter font, with a reasonably high x-height and is extremely readable on the screen. It is used in various sizes, in both plain and bold. Italic is not recommended for screen display due to stepping problems. Helvetica is the type face used in the navigation system. The tall x-height makes it more easily displayed at extremely small sizes.

Colours:

The required display speed dictated a simple colour palette.

Green – cyan 100%, magenta 15%, yellow 100%

Red – magenta 100%, yellow 100%

Blue – cyan 100%, magenta 100%

Illustration 6.24
new grid structure

All screened down colours are 50% of the original colour

Overhead title is 18pt bold Palatino white centered

icon placement

TITLE - title in 18pt bold Palatino uppercase

Subtitle in 18pt on 20pt. plain Palatino

Questions in red,

other text in black.
14pt. on 18pt leading, plain regular Palatino, flush left
avoid hyphens, watch line breaks

EXPLORERS

QUIT

INTRODUCTION TO POLYNOMIALS

OBJECTIVES 0 1 2 3 4

PAGES 1 2 3

>>

Layout Revisions – Menu

Mathematics 30^{CAI}

Following are the units of instruction that are available. Please click on the unit of your choice or select prescribed sequence.

Unit 1 – Polynomial Functions

Unit 2 – Logarithms

Unit 3 – Sequences, Series and Limits

Unit 4 – Trigonometry

Unit 5 – Quadratic Relations

Unit 6 – Statistics

Unit 7 – Permutations & Combinations

Show Performance Records

Resume to the Location you were at prior to Quitting

Level 4 Mathematics

Mathematics 30

Following are the units of instruction. Please click on the unit of your choice or select prescribed sequence.

Unit 1	Polynomial Functions
Unit 2	Exponential & Log Functions
Unit 3	Sequences, Series and Limits
Unit 4	Trigonometry
Unit 5	Quadratic Relations
Unit 6	Statistics
Unit 7	Permutations & Combinations

RESUME TO THE LOCATION YOU WERE AT PRIOR TO QUITTING

QUIT

>>

Layout Revisions – Overview

Overview

Topic 1

Introduction to
Polynomial Functions

objective
pre
1
2
3
4
pages
1
2
3

Do you remember what a polynomial is?

A polynomial is the sum of terms in which the coefficients of constants are real numbers and the exponents of the variables are whole numbers.

The intent of this topic is to help you understand the meaning of a polynomial function and to give you a review of the process of division of polynomials.

Return

Unit 1 – Topic 1

OVERVIEW

Introduction to
Polynomial Functions

Do you remember what a polynomial is?

A polynomial is the sum of terms in which the coefficients or constants are real numbers and the exponents of the variables are whole numbers.

The intent of this topic is to help you understand the meaning of a polynomial function and to give you a review of the process of division of polynomials.

EXPLORERS
QUIT

INTRODUCTION TO POLYNOMIALS

OBJECTIVES 0 1 2 3 4
PAGES 1 2 3

>>

Layout Revisions – Concepts

Illustration 6.27a original example screen with irregular line lengths and inconsistant grid

Example ⓪ Let us consider a steel cube 2 cm on a side.

Now suppose that the steel cube was uniformly coated with a layer of ice.

What is the volume of ice surrounding the cube?

Solution

The volume of ice on the cube is **dependent** on the thickness of the ice on each face. If the thickness changes, the volume changes; that is, the volume is a function of the thickness.

ice

2 cm

face
of
cube

objective
pre
1
2
3
4
pages
1
2
3
4
5

Return

Illustration 6.27b redesigned example screen using a two column grid

Unit 1 – Objective 1

Understanding the Concepts

What is the volume of ice surrounding the cube?

Let us consider a steel cube 2 cm on a side.

Now suppose that the steel cube was uniformly coated with a layer of ice.

Solution

The volume of ice on the cube is dependent on the thickness of the ice on each face. If the thickness changes; that is, the volume is a function of the thickness.

ice

2 cm

face
of
cube

EXPLORERS

QUIT

INTRODUCTION TO POLYNOMIALS

OBJECTIVES 0 1 2 3 4

PAGES 1 2 3

>>

Testing Methods and Procedures

The test group included 20 high school students currently enrolled in the Math20 program at a local academic school. They were chosen because all were honours students with high marks in most subjects. This meant that there was little difference in their math skills. They tested Unit 1 - Topic 1, which is actually a review unit and since the class was only two thirds of the way through Math20, it was basically new material to them.

A computer laboratory of twenty Macintoshes was divided into two sections, ten computers had the old version of the program, and ten had the new. The students were given a brief introduction and some basic computer instructions about using the mouse and hitting the return key. Each was given 30 minutes and asked to record where they were in the program when they finished. They then filled out the following questionnaire, adapted from Shneiderman (402 - 407) and made any written comments on the back.

Illustration 6.28 evaluation form

User Evaluation for Math30

Computer Station #:

Time started: Finished at: (shown on bottom of screen)

Time finished: Objective #:   Page #:

PLEASE CIRCLE THE MOST APPROPRIATE ANSWER

1 Characters in the display	unreadable 0 1 2 3 4 5 6 7 8 9 10	readable
2 Character definition	fuzzy 0 1 2 3 4 5 6 7 8 9 10	sharp
3 Character contrast with background	poor 0 1 2 3 4 5 6 7 8 9 10	excellent
4 Character shape (fonts)	unreadable 0 1 2 3 4 5 6 7 8 9 10	readable
5 Space surrounding characters	inadequate 0 1 2 3 4 5 6 7 8 9 10	adequate
6 Levels of intensity or boldfacing	hard to see 0 1 2 3 4 5 6 7 8 9 10	clear
7 Information feedback is appropriate	never 0 1 2 3 4 5 6 7 8 9 10	always
8 Instructions describing tasks	confusing 0 1 2 3 4 5 6 7 8 9 10	clear

	confusing	clear
9 Instructions for commands or choices	0 1 2 3 4 5 6 7 8 9 10	

	confusing	clear
10 Instructions for correcting errors	0 1 2 3 4 5 6 7 8 9 10	

	never	always
11 Instructions are consistent	0 1 2 3 4 5 6 7 8 9 10	

	impossible	easy
12 Go back to previous display	0 1 2 3 4 5 6 7 8 9 10	

	many	few
13 Number of operations per task	0 1 2 3 4 5 6 7 8 9 10	

	never	always
14 A title identifies the display	0 1 2 3 4 5 6 7 8 9 10	

	too much	adequate
15 Amount of feedback	0 1 2 3 4 5 6 7 8 9 10	

	never	always
16 Display layout simplifies tasks	0 1 2 3 4 5 6 7 8 9 10	

	cluttered	uncluttered
17 Displays	0 1 2 3 4 5 6 7 8 9 10	

	disorderly	orderly
18 Displays	0 1 2 3 4 5 6 7 8 9 10	

	inappropriate	appropriate
19 Colour changes not applicable	0 1 2 3 4 5 6 7 8 9 10	

	confusing	clear
20 Sequence of displays	0 1 2 3 4 5 6 7 8 9 10	

	never	always
21 Error messages indicate actions to be taken	0 1 2 3 4 5 6 7 8 9 10	

	impossible	easy
22 Maintain a sense of position	0 1 2 3 4 5 6 7 8 9 10	

	never	always
23 Instructions have consistent position	0 1 2 3 4 5 6 7 8 9 10	

	never	always
24 Error messages are specific	0 1 2 3 4 5 6 7 8 9 10	

	unpredictable	predictable
25 Next screen in sequence	0 1 2 3 4 5 6 7 8 9 10	

	never	always
26 Error messages clarify the problem	0 1 2 3 4 5 6 7 8 9 10	

Please note any other comments about what you liked or disliked about the program on the back of this sheet.

Results and Comments

While the students had the same skill level in the subject of Mathematics, it was soon obvious that the degree of computer literacy varied greatly. Three of the students were very proficient on the computer, two had next to no experience using either the computer, or a mouse, and the majority had typical word processing skills. Another drawback was the novelty of using the computer as a teaching tool. The students had no prior experience with IMMI and they were enthralled by the technology, regardless of which version they were testing. Therefore, most of the comments have little to do with the visual interface. Students were too intent on the content, in spite of my opening remarks regarding the visual interface.

Results of Questionnaire (Averages)

the students were asked to rate the following:

Illustration 6.29

		ratings		
1 Character in display		old	8.1	
	unreadable/readable	new	8.9	
2 character definitions		old	8.4	
	fuzzy/sharp	new	8.5	
3 characters contrast with background		old	8.7	
	poor/excellent	new	8.7	
4 character shape (fonts)		old	8.8	
	unreadable/readable	new	8.6	
5 shape surrounding characters		old	8.8	
	inadequate/adequate	new	7.2	
6 level of intensity or boldfacing		old	8.5	
	hard to see/clear	new	8.5	
7 information feedback is appropriate		old	6.6	
	never/always	new	7.0	
8 instructions describe tasks		old	6.6	
	confusing/clear	new	6.3	
9 instructions for commands or choices		old	6.7	
	confusing/clear	new	7.0	
10 instructions for correcting errors		old	6.7	
	confusing/clear	new	6.6	
11 instructions are consistent		old	7.9	
	never/always	new	8.1	

ratings 1 2 3 4 5 6 7 8 9 10

			ratings		
12 go back to previous page			old	5.9	
	impossible/easy		new	6.2	
13 number of operations per task			old	7.3	
	many few		new	6.6	
14 a title identifies the display			old	6.8	
	never/always		new	7.6	
15 amount of feedback			old	6.9	
	too much/adequate		new	7.4	
16 display layouts simplify tasks			old	6.6	
	never/always		new	7.3	
17 displays			old	7.6	
	cluttered/uncluttered		new	7.4	
18 displays			old	7.8	
	disorderly/orderly		new	7.7	
19 colour changes			old	N/A	
	inappropriate/appropriate		new	7.5	
20 sequences of displays			old	7.2	
	confusing/clear		new	7.8	
21 error messages indicate actions to be taken			old	6.8	
	never/always		new	7.1	
22 maintain sense of position			old	6.4	
	impossible/easy		new	7.3	
23 instructions have consistent position			old	8.6	
	never/always		new	7.9	
24 error messages are specific			old	5.7	
	never/always		new	6.1	
25 next screen in sequence			old	6.2	
	unpredictable/predictable		new	7.0	
26 error messages clarify the problem			old	5.9	
	never/always		new	6.1	

Comment by Students

The following comments refer only to the visual interface comments of both the old and new versions of Math30.

Three students viewing the old version noted the lack of colour and felt it was boring , while two others thought the clear simpleness of the program was 'nice'. One student said the font selection of Chicago was too small in

some of the boxes. Other comments referred to the letterspacing being too tight and a confusion between the letter 'x' and the letter 'h'.

Only two students spoke of a visual aspect other than colour or font selection. They felt the 'X' was too large for the wrong answer statement and that the exclamation point after "that's incorrect!" was too rude.

There were only three comments concerning the visual interface of the new version of the program. One student mentioned that the typeface should be larger and one thought that there was too much information on the screen at one time. The final comment came from a student with advanced computer knowledge. He wondered why there was no sound or Hypertext in the program.

Summary

Ideally, a visual communicator should have been involved in this project from the beginning, helping to determine not only the colour, visual icons and font selection but also have a hand in how the information flows from screen to screen and in the structural design of the navigation system. There also needs to be more testing done on the suitability of the new icons and the basic grid layout.

The redesigns shown here are a good start, a reasonable transition from the black & white version to, hopefully, the fully developed interactive multimedia version of the future.
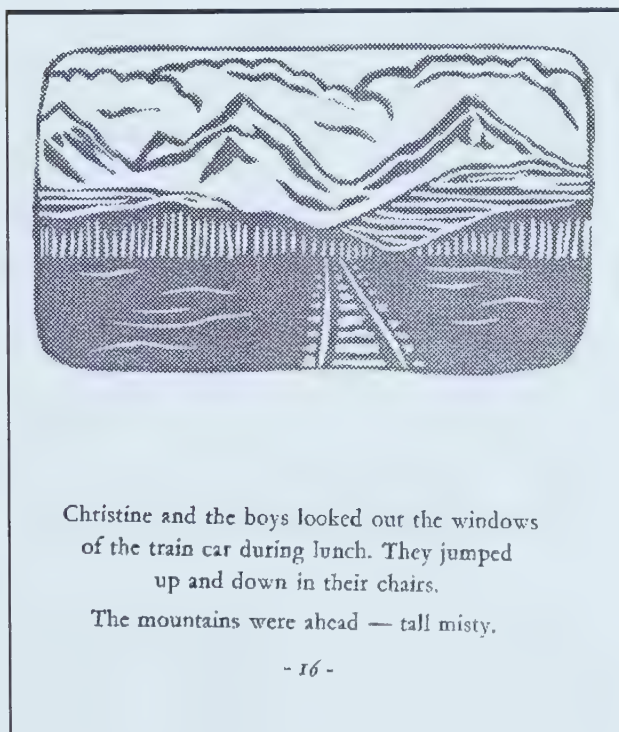
Chapter 7 – Case Study 2: *We're Moving!*

Introduction

This interactive multimedia instructional application, created in Hypercard 2.2, originated as a children's story printed on the letterpress. It is the story of a little girl's journey across Canada by train. As she travels, Christine sees the unique sights that make Canada great. I thought it would make an interesting teaching tool, using the story as the pivoting point and incorporating lessons in geography, art and how to use a database.

Christine and the boys looked out the windows of the train car during lunch. They jumped up and down in their chairs.
The mountains were ahead — tall misty.

- *16* -

Illustration 7.30 example of letterpress

Analysis of project

This project is not meant to be a standalone, where students sit individually in front of the computer and view 'We're Moving!' in isolation. It is a teaching tool where the teacher orchestrates how and when the students are introduced to the various components of the program. It is also open-ended, with one of the features being the possibility of adding to the Hypercard stacks by both the teacher and the students.

There are five major sections or pathways the users can follow. The story can be read alone or as each page is read, the user can see where the train is on the Canada map, or look at a Canadian painting relevant to the story's illustration. The students have the option of seeing where they are within the database at any time by clicking on the navigation - Where am I? button. This stack also allows for easy access to any part of the program at any given time. The final section is the activities stack, one for
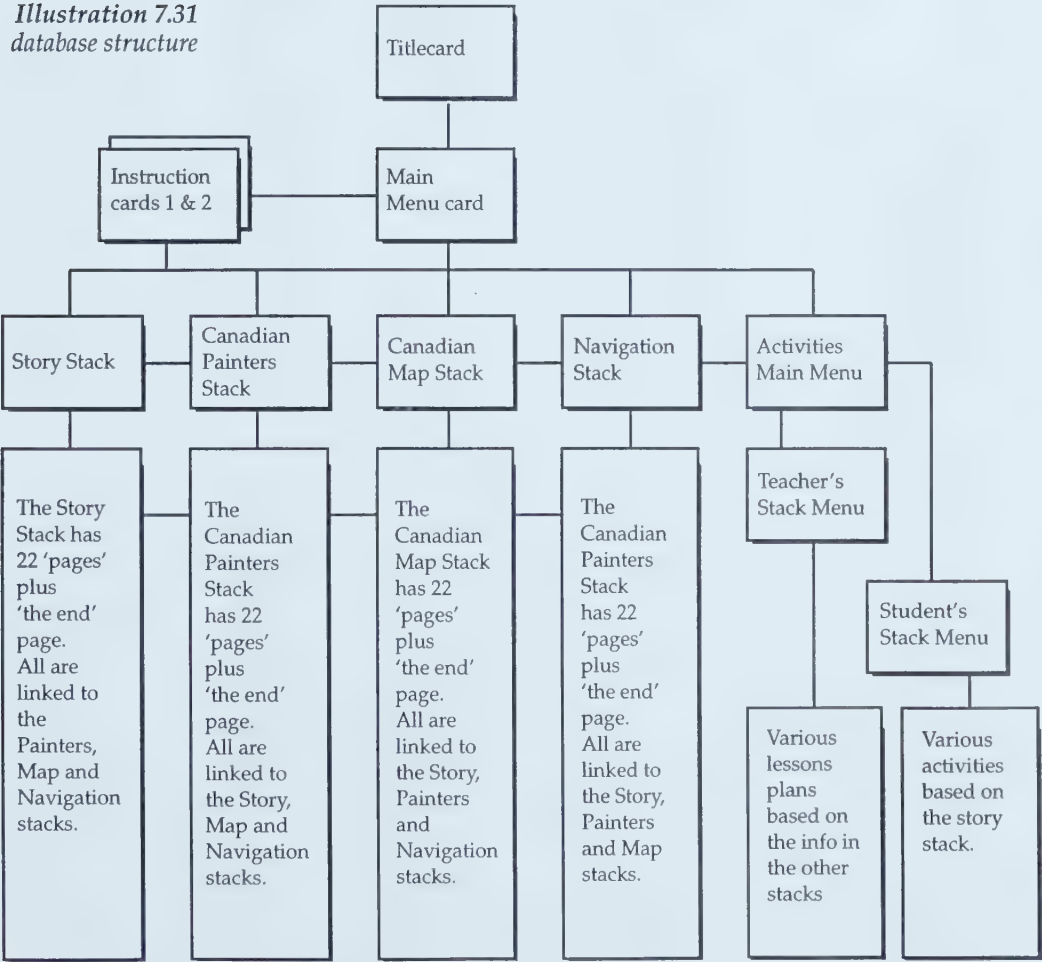
teachers and one for students. There are simple lesson guides about colour theory, painting style and geography for the teacher and a variety of puzzles, crosswords and drawing activities for the students.

Navigation Stack – Hypercard

As the computer becomes a more integral part of the classroom, students will need to understand how networking works. The application provides an opportunity to learn about databasing, particularly Hypercard. Hypercard allows novices to create simple stacks. A stack is the term used for one page or card of information. It can contain buttons, text and images that are linked to other cards and other stacks. The programming is very intuitive and can be accomplished through the use of icons and menu items. As the user becomes more familiar with the program, their application can become more complex.

Illustration 7.31
database structure

Titlecard

Instruction cards 1 & 2

Main Menu card

Story Stack

Canadian Painters Stack

Canadian Map Stack

Navigation Stack

Activities Main Menu

The Story Stack has 22 'pages' plus 'the end' page. All are linked to the Painters, Map and Navigation stacks.

The Canadian Painters Stack has 22 'pages' plus 'the end' page. All are linked to the Story, Map and Navigation stacks.

The Canadian Map Stack has 22 'pages' plus 'the end' page. All are linked to the Story, Painters and Navigation stacks.

The Canadian Painters Stack has 22 'pages' plus 'the end' page. All are linked to the Story, Painters and Map stacks.

Teacher's Stack Menu

Student's Stack Menu

Various lessons plans based on the info in the other stacks

Various activities based on the story stack.

Story Stack – Language Arts

Although aimed at Grade Three, the story can be read by young readers. According to the curriculum guidelines in language arts set by the Alberta Education Department, "Illustrations may still be used to provide further insight … [they] organize their talk or writing around a topic of personal interest and elaborate on it" (45). The story combined with the personal story stack gives the learners the opportunity to write about their travels. The sound button gives the audio version of Christine's story as well.

Canadian Map Stack – Social Studies/Geography

Students in grade three are introduced to the concept of community, first on a local level, then moving on to the provinces and country. 'We're Moving!' gives them a sense of not just their individual communities, but also where they fit within Canada. Stacks about the local, regional or provincial geography can be created by the class.

Canadian Painters Stack – Art

The painting stack touches on some of the history and diversity of Canadian painters in this country. The teachers should expand the lesson through this stack to include other artists, especially local ones. Students could also create their own images, either scanning in their traditional drawings, or creating them directly in their stacks using the simple black & white paint function of Hypercard. At this time, Hypercard 2.2 can only import colour PICT files, not create them.

Activities Stack – Teacher's guide

This stack is meant to be an idea generator. It is incomplete or open ended so that teachers will feel comfortable adding their own resources and information as they go along. A resource is included in the stack.

Activities Stack – Student's stack

The program comes with one student stack, with instructions on how to make multiple copies for each member of the class. The activities are only the starting point and students should be encouraged to expand the stack with their own ideas. Examples for projects are included in the teacher's guide.

Interviews

The six students interviewed range from a Grade One student with little computer experience to a Grade Three student, reading at a Grade Five level. One of the teachers interviewed is an elementary school principal with Grade Two teaching experience and the other is an elementary school art teacher.

The students and teachers were individually interviewed one-on-one in a computer laboratory. The program was preloaded and ready for use when each person came in. Before starting the interview, a series of questions were asked about each student's previous computer experience. They were then introduced to the program as though a teacher were there. Students were then asked to interact with the program as they wished, asking questions when necessary.

Results and Comments

All students had used a computer with a mouse at school for a math game. Four students had access to a computer at home, though all were allowed only limited time on them. All said they liked using the computer.

As a result of observing the users for at least thirty minutes each, the following issues and suggestions were brought up:

- Less experienced computer users had trouble controlling the mouse and should be given extra instructions when starting the program.
- One Grade Two student was eager to hear the sound on each illustration and went to the illustration first. Therefore, sounds should be independent of the text on the story page.
- Younger readers had the text read aloud without trying to read from the screen.
- The students with higher reading levels read the story from the screen, one straight through and the other exploring as she went from page to page. Keeping the thread of the story was a problem for the youngest student.
- Some students weren't sure whether they had clicked on the button and sometimes clicked twice. All buttons should be auto highlighted so that the student knows they have pressed it. A wait symbol should appear immediately.

- All the students were very intent on getting to the activity stacks. Once there, they were eager to use the mouse to draw, but were disappointed that it was only black & white.

Both teachers were impressed with the program and its potential as a teaching tool. Perhaps because both have little computer experience, they were more in awe of the program itself than the students were. They liked the open-endedness of the stacks and the fact that teachers will have the opportunity to 'make it their own'. One teacher suggested that younger students be encouraged to pair up when first using the program. This would make it more accessible to less advanced readers or students unfamiliar with using the computer.
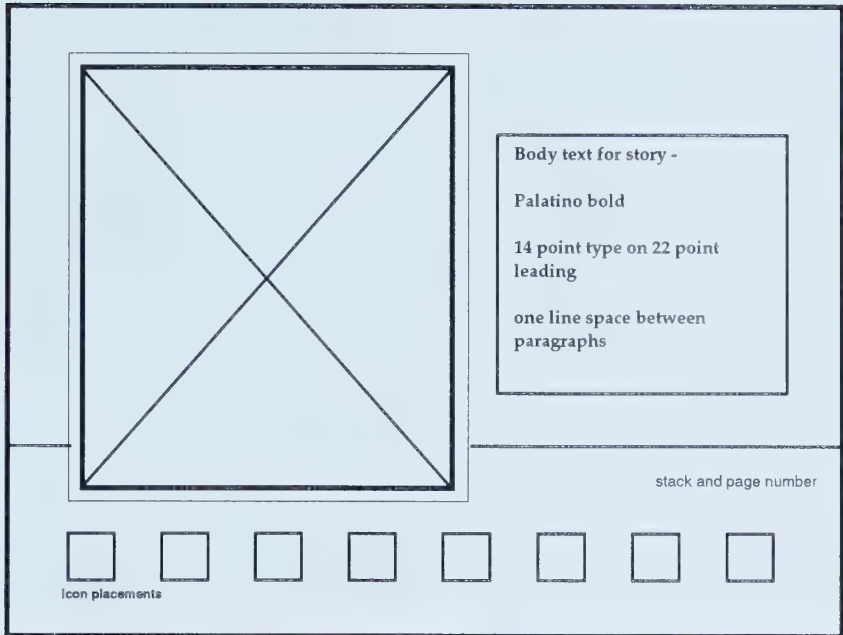
Summary

The Alberta Education Department's curriculum guide states, " … skills are not intended to be developed separately or sequentially but are intertwined with the knowledge and attitude components. Skill development is enhanced through integrated instruction and by use in a variety of contexts" (48). While "We'reMoving!" has the potential of allowing teachers to integrate the subjects of language arts, social studies and art, the next step in its development is to have the context redeveloped by an educator and the application refined by a programmer. As stated throughout this thesis, interactive multimedia instructional applications are best designed by a team of people, all experts in their field.
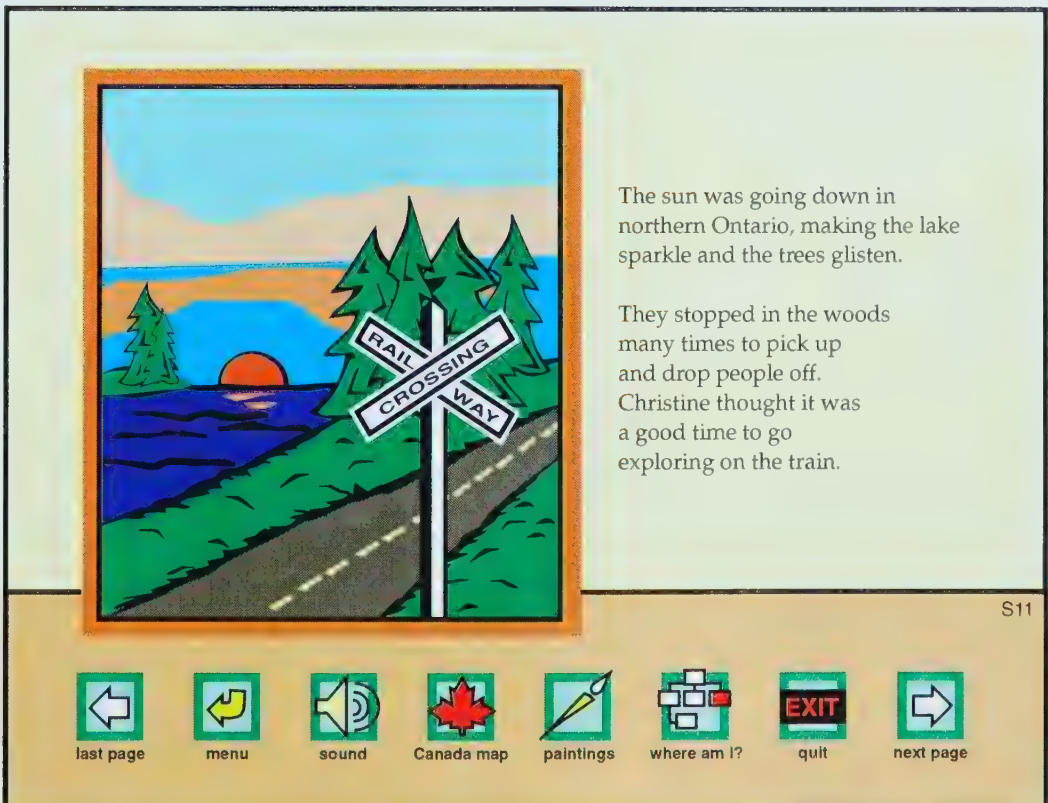
Visuals of Stacks

Body text for story -

Palatino bold

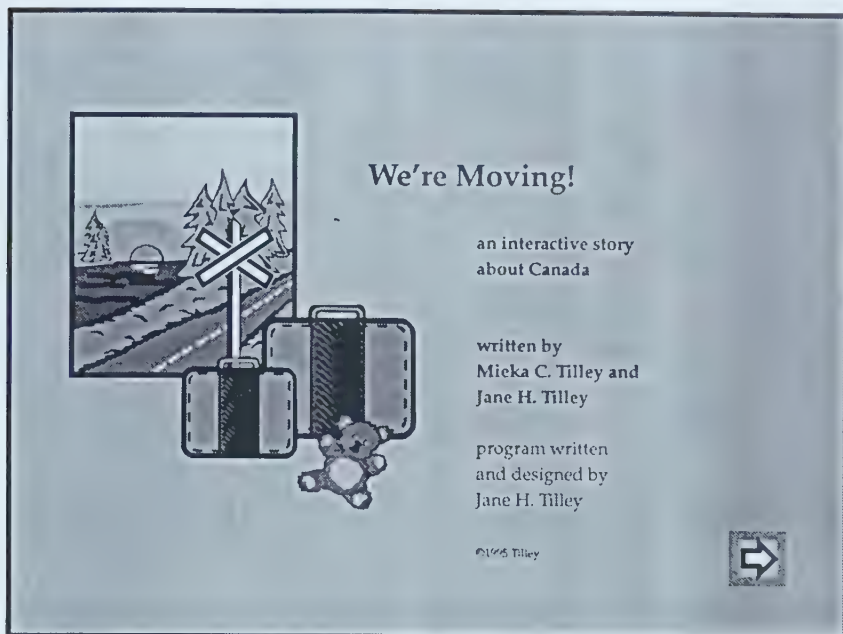14 point type on 22 point leading

one line space between paragraphs

stack and page number

Icon placements

The sun was going down in northern Ontario, making the lake sparkle and the trees glisten.

They stopped in the woods many times to pick up and drop people off. Christine thought it was a good time to go exploring on the train.

S11

| last page | menu | sound | Canada map | paintings | where am I? | quit | next page |

Illustrations of Stacks

We're Moving!

an interactive story
about Canada

written by
Mieka C. Tilley and
Jane H. Tilley

program written
and designed by
Jane H. Tilley

©1995 Tilley

Menu

click on the book to read the story

click on the brush to see the paintings

click on the leaf to see the Canadian Map

click on the pencil to go to the activities

click on question mark for instructions
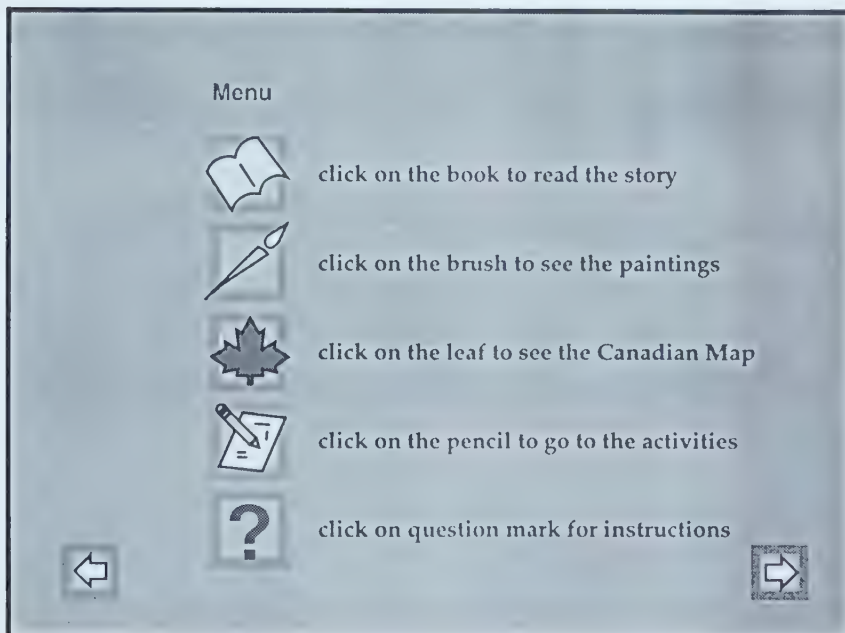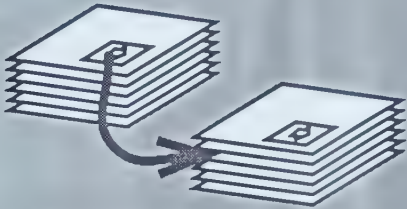
Illustrations of Stacks

How does Hypercard work?

Think of Hypercard as a bunch
of cards that are put into piles
so you can look at them.
Each pile is called a stack.
You can go from one card
in one stack to another
card by clicking on the buttons.
Buttons can also be used to
give you sound or help you quit.

In the story stack, you can also
click somewhere on the picture
to hear a special sound.

Find where
the sound is
on the story's
picture and guess
what it is.

Click on the arrow to continue

What do the buttons do?

back to story
this gets you
to the
story stack

Canada map
this gets you
to the
geography stack

paintings
this gets you
to the Canadian
art stack

where am I?
this tells you
where in the
stacks you are

activities
this gets you
to the
teacher's and
student's stacks

last page
you go
back one card
in the stack

menu
you go
back to the
main menu

sound
you hear
the story
or title of card

quit
you can
quit the
program

next page
you go
to the next
card or stack

Click on the next page icon to continue

Illustrations of Stacks

Looking out the window
of the train car
during lunchtime,
Christine and the boys
jumped up and down
in their chairs.

The mountains were ahead
— tall and misty

S18

last page   menu   sound   Canada map   paintings   where am I?   quit   next page

"Landscape with Deer" 1965

Jan Gerrit Wyers
1888 ~ 1973

Born in Holland, Jan
came to Canada in 1916.
He lived and worked
on a farm in Windhorst,
Saskatchewan.

This is an oil painting
done on canvas board.
55.9 x 71.1 cm.

P18

last page   menu   sound   Canada map   back to story   where am I?   quit   next page

Illustrations of Stacks

Canada's biggest mountain range is called The Rockies.

last page | menu | sound | paintings | back to story | where am I? | quit | next page

Where am I?

You are on page 18
of the story stack.

To go to another card,
just click on the square you want.

story stack

S | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | **18** | 19 | 20 | 21 | 22 | 23

paintings stack

P | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23

title — menu

Canada map stack

M | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23

activities stack

A | menu | teacher's | student's

Illustrations of Stacks

Activity Menu

Teacher's Activities
includes Candian painters, colour theory,
geography, and hypercard ideas

Students's Activities
names can be changed using the eraser
and "A" tools.

last page   menu   back to story   Canada map   paintings   where am I?   quit   next page

Teacher's activities

Ideas for Painting Projects

About Colour Theory

Canadian Geography

Information about Hypercard

last page   menu   back to story   Canada map   paintings   where am I?   quit   next page

Illustrations of Stacks

Student's activities

Create Your Own

Word Puzzles

Going Places

Sights and Sounds

last page   menu   back to story   Canada map   paintings   where am I?   EXIT quit   next page
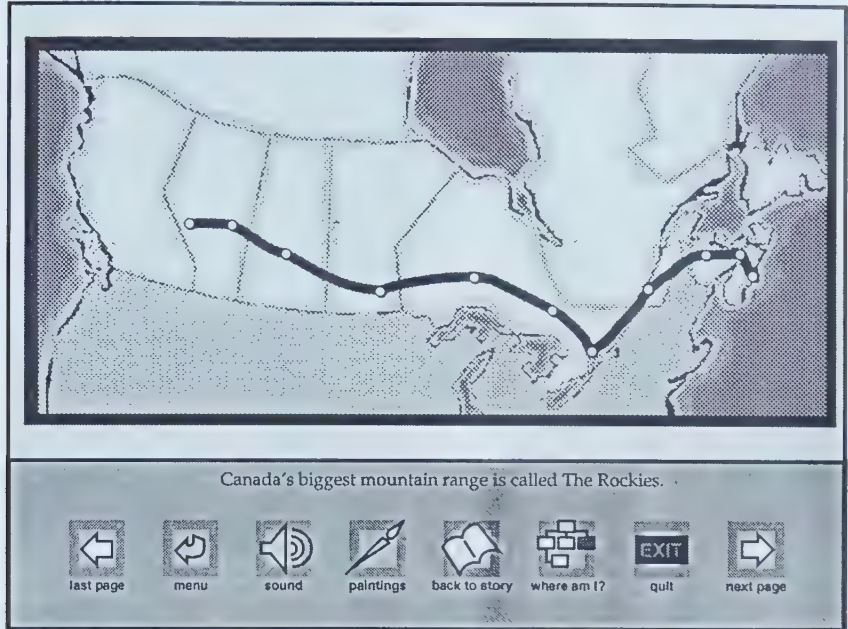
Crossword Puzzle

Click on the "A" in the "Tools"
menu and then click where
you want to put a letter.
You can always erase your
answers with the eraser.
Return to browse tool
to get answers
or continue to
next page.

Answers
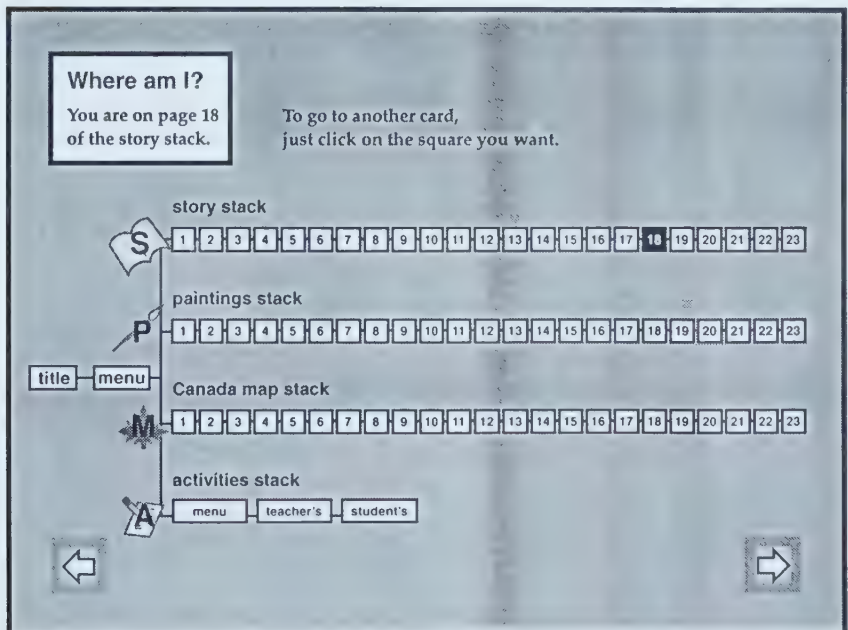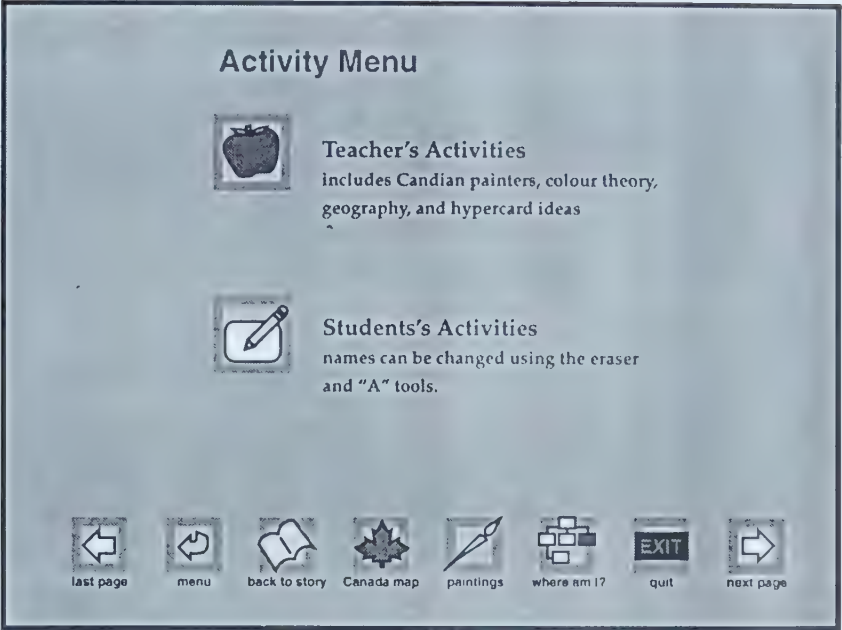
last page   menu   EXIT quit   next page

Chapter 8 – Conclusion

Creating interactive multimedia instructional programs is a complex process, involving expertise in project management, content development, visual communications and programming. It is rare to have that expertise all in one person. Frank Maddix speaks of the need for team collaboration, "A good furniture designer talks to anatomists and ergonomists, as well as fabric designers; but cognitive psychologists are not usually at the top of the system designers contact list. This is a pity, as they would probably discover they have a lot in common" (256). Not only would they find their commonality, but as a team they can create the best product.

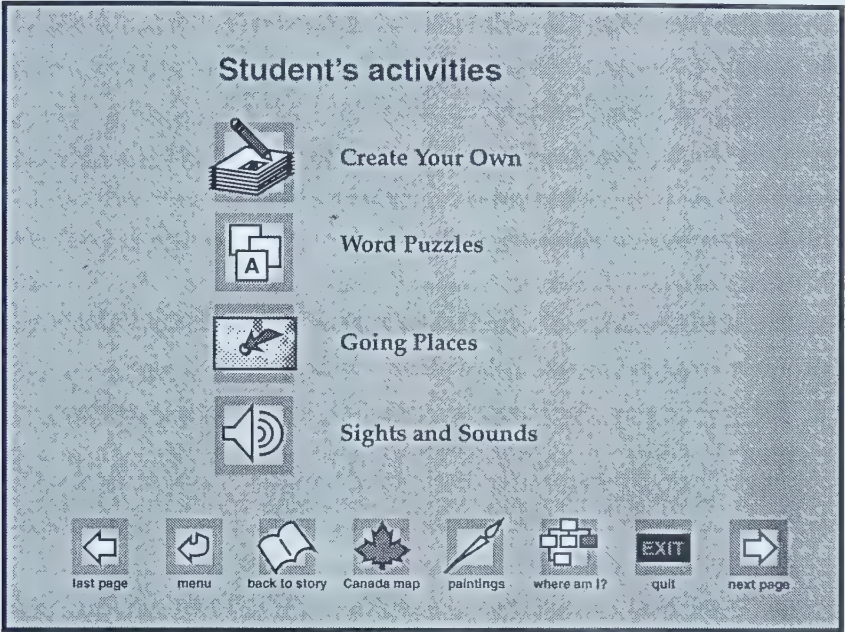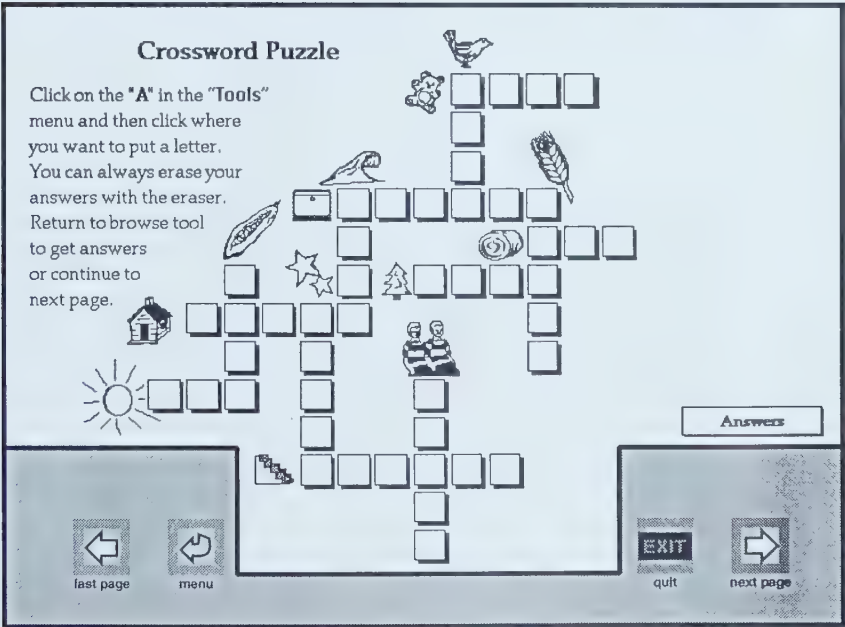This thesis covers some of the topics the design team or the individual must deal with in order to create an application that effectively communicates the objectives of their lesson plans and goals. How the information is visually ordered and displayed requires good planning and following basic guidelines. Not all projects will have the option of team collaboration, but the IMMI learning resources provided by individual educators can still be readable, and accessible to users.

Future Research

Throughout this thesis references have been made to the fact that there is currently very little testing research as to the success of IMMI in the classroom. More studies need to be done on font selection, colour and icon development, and other attributes regarding navigation and screen designs of this teaching method. As the technology changes, providing developers with easier-to-use authoring tools, guidelines must be established regarding how best to use those tools.

Works Cited

Alberta Education. *Grades 4 - 6 Social Studies Teacher Resource Manual.*
   Edmonton, Alberta: Alberta Education, 1989.

Aspillaga, Macarena. **Implication of Screen Design Upon Learning**.
   Journal of Educational Technology Systems 20.1 (1991):.53-58.

Barker, John, and Tucker, Richard N., eds. *The Interactive Learning
   Revolution: Multimedia in Education and Training*. London, UK:
   Kogan Page, 1990.

Boling, Elizabeth. **Meeting the Challenge of the Electronic Page:
   Extending Instructional Design Skills**. *Educational Technology*
   34.7 (1994): 13-18.

Booth, Paul. *An Introduction to Human–Computer Interaction*.
   East Sussex, UK.: Lawrence Erlbaum, 1989.

Bruce, I., and McKennell, A., and Walker, E. *Blind and Partially Sighted
   Adults in Britain: The RNIB Survey Vol1*. London: HMSO, 1991.

Dillon, A., and McKnight, C., and Richardson, J. **Reading from Paper
   versus Reading from Screen**. *Computer Journal* 31.5 (1988): 456-464.

Frase, Lawrence, and Schwartz, Barry. **Typographical Cues That
   Facilitate Comprehension**. *Journal of Educational Psychology*
   71.2 (1979): 197-206.

Galbreath, James. **Multimedia in Education: because it's there?**.
   Tech Trends 39.6 (1994): 17-20.

Gagné, Robert, and Briggs, Leslie. *Principles of Instructional Design*.
   New York: Rinehart and Winston, 1979.

Grimes, John. **Issues in Multimedia Publications**. *Design Process Newsletter* 4.6 (1992): 1-5.

Maddix, Frank. *Human—Computer Interaction: Theory and Practice.* West Sussex, England: Ellis Horwood, 1990.

Computers just kids' play **Mail Star** Halifax 22 April 1994: B7.

Marshall, David. *CAL/CBT - the great debate.* Lund: Chartwell - Bratt Student Litteratur, 1988.

Morrison, Gary, and Ross, Steven, and Shultz, Charles, and O'Dell, Jacqueline. **Learner Preferences for Varying Screen Densities Using Realistic Stimulus Materials With Single and Multiple Designs**. *Educational Technological Research and Development* 37.3 (1984): 53-60.

Park, Ok-choon. **Dynamic Visual Displays in Media-based Instruction**. *Educational Technology* 34.4 (1994): 21-25.

Schwier, R.A. and Misanchuk, E.R. *Interactive Multimedia Instruction.* Englewood Cliffs, NJ: Educational Technology Publication, 1993.

Shneiderman, Ben. *Designing the User Interface: Strategies for Effective Human—Computer Interaction.* Reading, Mass: Addison - Wesley, 1987.

Soulier, J. Steven. *The Design and Development of Computer Based Instruction*. Newton, Mass.: Allyn & Bacon, 1988.

Staninger, Steven. **Hypertext Technology: Educational Consequences**. *Educational Technology* 34.6 (1994): 51-53.

Sweeter, William. **Multimedia Electronic Tools for Learning**. *Educational Technology* 34.5 (1994): 47-52.

Tinker, Miles. *Bases for Effective Reading.* Minneapolis, Min.: University of Minnesota Press, 1994.

van Nes, Floris L. **Legibility of Visual Display Texts.** *Human—Computer Interaction: Psychonomic Aspects* eds. van der Veer, Gerrit C. & Mulder, Gijsbertus New York: Springer - Verlag, 1988. 14-25.

Wei, Chin-lung. **Hypertext and Printed Materials: Some Similarites and Differences**. *Educational Technology* 31.3 (1991): 51-53.

Yong, Yeow-Chin. **CAL for Mathematics and Science teaching** *Multi-Media Computer Assisted Learning*. Ed. Philip Barker. London: Kogan Page, 1982. 78-96

Appendix A – Other Relevant Works

Visual Communication References

Craig, James and Bevington, William. *Working With Graphic Designers.*
    New York: Watson-Guptill Publications, 1989.

Dair, Carl. *Design With Type.* Toronto: University of Toronto Press, 1985.

de Sausmarez, Maurice. *Basic design: the dynamics of visual form.* New
    York: Van Nostrand Reinhold, 1970.

Dondis, Donis. *A Primer of Visual Liteacy.* Cambridge, Mass.:
    MIT Press, 1973.

Meggs, Philip. *Type & Image: The Language of Graphic Design.*
    New York: Van Nostrand Reinhold, 1992.

Interactive Multimedia References

Ambrose, David W. **The Effects of Hypermedia on Learning: A
    Literature Review**. *Educational Technology* 31.12 (1991): 51-55.

Badre, Albert N. **Designing Transitionality Into the User-Computer
    Interface.** *Human—Computer Interaction* ed. Gavriel Salvendy.
    Amsterdam: Elsevier, 1984. 27-42

Barker, Philip. **An Object Oriented Approach to Hypermedia Authoring**
    *Interactive Multimedia Learning Environments: Human Factors and
    Technical Considerations on Design Issues* ed. Max Giardina. Nato ASI
    Series Vol 93. 1992. 132-152.

Barker, Philip. **Authoring for CAL** *Multi-Media Computer Assisted Learning.*
    ed. Philip Barker. London: Kogan Page. 1982. 210-224.

Cates, Ward Mitchell. **Fifteen Principles for Designing More Effective Instructional Hypermedia/Multimedia Products**. *Educational Technology* 32.12 (1992): 5-11.

Hoekema, Jim. **Hypercard and CD-1: The 'Mutt and Jeff' of Multimedia Platforms**. *Educational Technology* 32.5 (1992): 28-34.

Jones, Mark K. *Human Computer Interaction: A Design Guide*. Englewood Cliffs, New Jersey: Educational Technology Publications, 1989.

Junkala, John. **Creating CAI Courseware for College-Level Instruction: Almost Anyone Can Do It**. *Educational Technology* 31.1 (1991): 15-20.

Lucas, Leslie. **Visually Designing the Computer-Learner Interface**. *Educational Technology* 31.7 (1991): 56-58.

Lanza, Antonietta. **Some Guidelines for the Design of Effective Hypercourses**. *Educational Technology* 31.10 (1991): 18-22.

Mayes, Terry. **The 'M-Word': Multimedia Interfaces and Their Role in Interactice Learning Systems**. *Multimedia Interface Design in Education* eds. Alistair D. N. Edwards & Simon Holland. New York: Springer - Verlag. 1992. 1-22.

Noordman, Leo G.M. **Visual Presentation of text**. *Human—Computer Interaction: Psychonomic Aspects*. eds. van der Veer, Gerrit C. & Mulder, Gijsbertus. New York: Springer - Verlag. 1988. 104-124.

Romiszowski, Alexander, & Chang, E-cheol. **Hypertext's Contribution to Computer-Mediated Communication: Search of an Instructional Model** *Interactive Multimedia Learning Environments: Human Factors and Technical Considerations on Design Issues* ed. Max Giardina. Nato ASI Series Vol 93. 1992. 111-130

Thimbleby, Harold, & Cockburn, Andy, & Jones, Steve. **Hypercard: An Object-Oriented Dissappointment.** *Building Interactive Systems: Architecture and Tools* eds. Philip Gray & Roger Took. New York: Springer - Verlag and British Computer Society. 1992. 35-55.

Tuttle, David M. **Interactive Instruction: Evolution, Convolution, Revolution** (1992) *Interactive Multimedia Learning Environments: Human Factors and Technical Considerations on Design Issues* Ed. Max Giardina. Nato ASI Series Vol 93.
1992. 165-173.

Watanabe, Yasuo. **To Improve M.M Interface.** *Human—Computer Interaction* Ed. Gavriel Salvendy. Amsterdam: Elsevier, 1984. 73-75.

Appendix B – Authoring Tools

Macintosh environments

Hypercard version 2.2:

Publisher: Apple Computers

Hardware requirements: Macintosh, 4 Mb RAM

Colour support: yes, but not ideal

Sound Recording: yes

Includes: simple bitmap paint program, B&W clipart, imports PICT images and Quicktime movies, links to videodisc player and CD-ROM

Licensing agreements: application users need to own either the software or the Hypercard player for B&W stacks. Single stacks (not linked) can be packaged as stand alones

Pros: basics learned quickly and intuitively

Cons: animation requires scripting, identifying names are not unique, can't group objects, slower than most other software, doesn't provide current location on the screen, saving done automatically

(note Hypercard 2.3 has just been released with new colour paint tools and is Power Mac compatible)

Supercard version 2.0:

Publisher: Allegiant

Hardware requirements: Macintosh, 4 Mb RAM,

Colour support: yes

Sound Recording: yes

Includes: colour paint program, imports PICT images and Quicktime movies, links to videodisc player and audio CDs

Licensing agreements: packaged as stand alones with royalty free distribution

Pros: will be Windows compatible soon

Cons: new release

Hyperstudio version 1.0:

Publisher: Roger Wagner Publishing

Hardware requirements: Macintosh, 4 Mb RAM (system 7)

Colour support: colour monitor recommended

Sound Recording: yes

Includes: 4 level fat bit paint program, colour clipart, imports PICT, EPS, TIFF images and digital movies, links to videodisc player and CD-ROM

Licensing agreements: Packaged as stand alones that are royalty free and can be distributed with the Hyperstudio Player

Pros: Short learning curve, similar to Hypercard 2.0 but with better colour applications

Digital Chisel version 2.0:

Publisher: Pierian Spring

Hardware requirements: Macintosh, 4 Mb RAM, CD-ROM for clipart

Colour support: yes

Sound Recording: yes

Includes: draw & paint program, clipart on CD-ROM, imports PICT images and digital movies, links to videodisc player and audio CDs

Licensing agreements: royalty free distribution of applications

Windows/DOS environments

Multimedia Toolbook version 1.5:

Publisher: Asymetrix

Hardware requirements: Window 3.1, 6 Mg RAM recommended, 386 processor or higher, CD-ROM

Colour support: yes

Sound Recording: yes, with proper card

Includes: simple paint program, clipart, imports EPS, TIFF, CGM and other images and digital movies, links to audio CDs and videodisc player

Licensing agreements: packaged as standalones with royalty free distribution

Pros: based on Supercard, quick learning curve for basic elements.

Authority version 2.0B:

Publisher: Interactive Image Technologies

Hardware requirements: Dos, 1 Mg RAM, 286 processor or higher

Colour support: yes

Sound Recording: yes, with proper card

Includes: simple paint program, clipart, imports PCX images and digital movies, links to CD-ROM, not videodisc player

Licensing agreements: royalty free distribution of application

LinkWay Live! version 1.1:

Publisher: EduQuest

Hardware requirements: Dos, 2 Mg RAM, 286 processor or higher

Colour support: yes

Sound Recording: yes, with proper card

Includes: text driven paint program, minimal clipart, imports ANM images directly with others through conversion and digital movies, links to CD-ROM and videodisc player

Shared environments (Mac & Dos)

Authorware version 3.0:

Publisher: Macromedia

Hardware requirements: Macintosh, 4 Mg RAM, or Windows

Colour support: yes

Sound Recording: yes

Includes: simple paint program, clipart, imports PICT, Tiff and EPS images and digital movies, links to CD-ROM, but not videodisc player

Licensing agreements: packaged as stand alones with royalty free distribution

Pros: Excellent testing management system, ideal for teaching subjects such as Mathemathics

Cons: Very linear in its approach, expensive, high learning curve

Additional Software (Mac & DOS)

Adobe Premiere version 4.0:

(for creating Quicktime digital movies)

Publisher: Adobe Systems

Hardware requirements: Macintosh (system 7), 16 Mg RAM recommended for full video, CD-ROM

Colour support: yes

Sound Recording: yes

Includes: imports PICT, Kodak Photo CD, TARGA images and other

Licensing agreements: can be distributed freely

Pros: Plenty of bells and whistles

Cons: Plenty of bells and whistles

Director version 4.0:

(for creating Quicktime digital movies)

Publisher: Macromind

Hardware requirements: Macintosh (system 7) with 68-20 provcessor or greater and 6 - 20 Mg RAM

Colour support: yes

Sound Recording: yes

Licensing agreements: can be distributed freely

Pros: Industry standard, new Power Mac version has faster editing tools

Cons: High learning curve

Soundwave version 1.2.1:

(standalone sound recorder)

Publisher: Authorware, Inc.

Hardware requirements: Macintosh (system 7), 2 Mg RAM

Colour support: yes

Sound Recording: yes

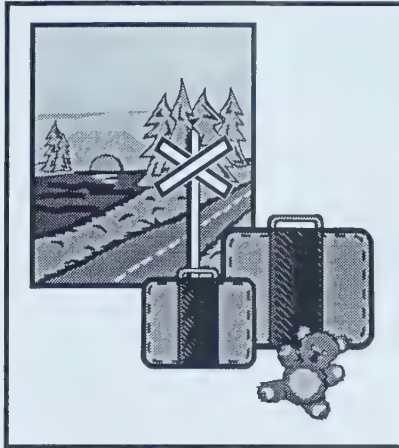**Licensing agreements:** can be distributed freely

Pros: easy to use editing functions

Cons: as with all other sound editing packages, high quality sound reproduction is memory intensive. Problems with Power Mac.

Appendix C – "We're Moving!"

We're Moving!

an interactive story
about Canada

written by
Mieka C. Tilley and
Jane H. Tilley

program written
and designed by
Jane H. Tilley

© 1995 Tilley Merks

page one

The day before
  Christine and her Mom
    moved away from Halifax,
      they went down to the
        nearby ocean.

The sparkling water swept ashore,
  waving, "goodbye, goodbye,
    we will miss you,
      we will miss you".

page two

The next day, their family
  went to the train station
    to see them off.

Grandma, Uncle Sandy and
  cousin Nikki waved,
      "goodbye, goodbye,
    we will miss you,
        we will miss you".
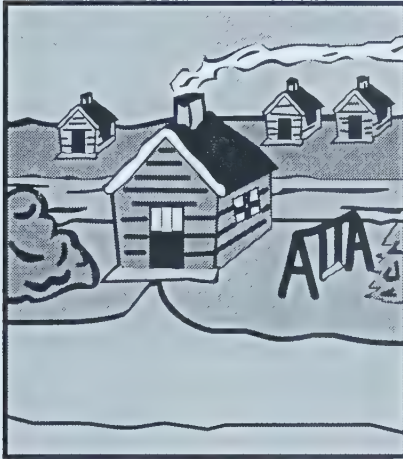
page three

Uncle Sandy was born
   in Newfoundland.
      It is a big island
         northeast of Nova Scotia.

Christine remembers visiting
   St. John's last summer,
and playing by a lighthouse
near the Atlantic Ocean.

page four

Christine watched the
      Nova Scotia countryside
      pass her window.

The brightly painted
      wooden houses flashed by
      as she settled in
      for the long ride.

page five

All the tables in the dining car
   were set with green and
      white tablecloths.

The birds on the marshlands
in New Brunswick
ate their supper while
Christine and her Mom
ate theirs.

page six

If Christine had gotten off
the train in Moncton,
she could have taken
the ferry boat over
to Prince Edward Island.

The earth there is bright red
and there are wonderful
beaches around the island.

page seven

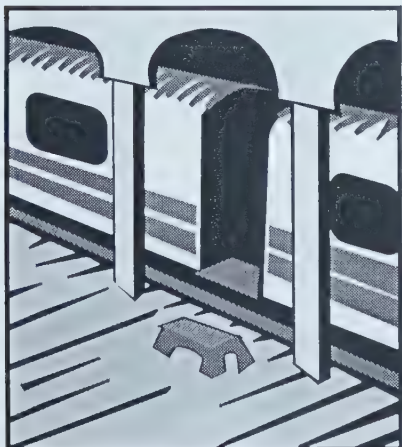When Christine and her Mom
got back to their own places,
there were two bunk beds
instead of seats.

Christine's top bunk bed
was like a cozy fort just for her.
She fell asleep to
the swaying of the train
and the clicking of the tracks.

page eight

It was dark
as the rocky shores
of northern
Quebec dissappeared.

The next morning, after breakfast
it was time for Christine
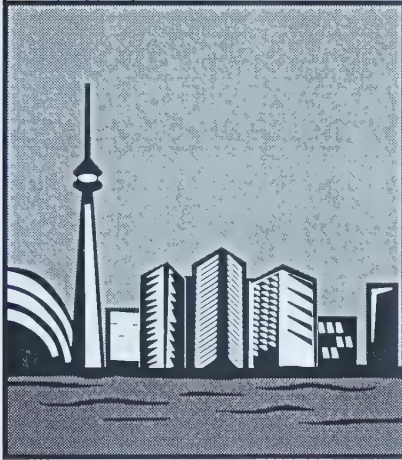to change trains
in Montreal.

page nine

On the new train, Christine's
            juice cup fit perfectly
                into the tray
                that was part of the seat.

She saw fields of yellow corn
        and gardens of vegetables
bursting with colour,
                along side the tracks.

page ten

Soon Christine started
        to see more and more buildings.
            They got taller and taller
                as she got closer
                and closer to Toronto.

The train station was
        big and busy —
            it was time to switch
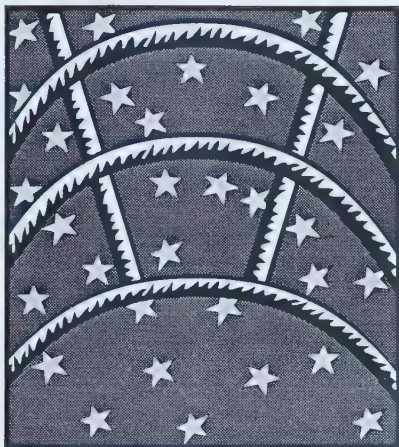   trains for the last time.

page eleven

The sun was going down in
northern Ontario, making the lake
sparkle and the trees glisten.

They stopped in the woods
many times to pick up
and drop people off.
Christine thought it was
a good time to go
exploring on the train.

page twelve

In one of the cars,
she climbed up some stairs
into a dome
and sat high on the seat
to look into the sky.

There were windows all around
and the stars twinkled
a special goodnight
to everyone.

page thirteen
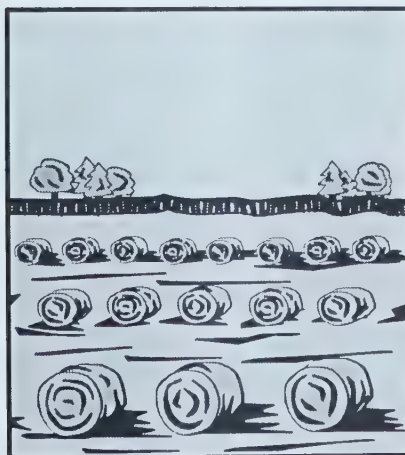

The forest seemed to go
on forever and ever
and there was telephone pole
after telephone pole.

Christine went back
to her bunk bed on the top berth
and quickly fell asleep.

page fourteen

In the daylight, she could
see the fields of Manitoba,
dotted with great big rolls of hay
ready for the barn.

Christine thought
the land looked very flat
and she could see
right across the sky.

page fifteen

The next day,
  she woke up in Saskatchewan,
    and there all the fields
    were golden
      with swaying wheat.

Tall grain elevators
  sat by the tracks
    ready to pour grain
into the cars.

page sixteen
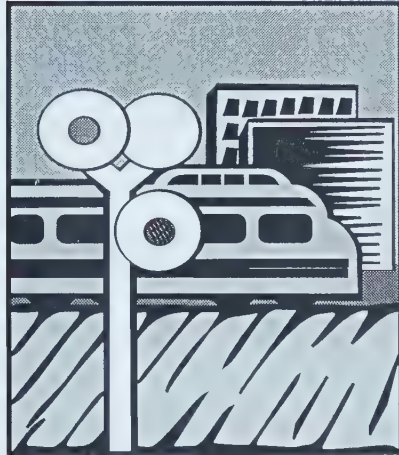
Soon they were in Alberta
  and the train
    had to go backwards
    to get into
    the Edmonton station.

Christine was surprised
  when twin boys
  and their Dad got on
  the train and sat
  across from her.

page seventeen

It was hard to tell
  the twins apart
except for the pair of glasses
  one of the boys wore.

"Hi, I'm Shawn".
"Hi, I'm Don".
They spoke at the same time.

page eighteen

Christine and the boys
looked out the window
of the train car during lunch.
They jumped up
and down in their chairs.

The mountains
were ahead
—
tall and misty.

page nineteen

There were lots of tunnels
and cliffs in the mountains
of British Columbia.

That night,
Christine had someone
to whisper to from her bed
as she went to sleep.
Tomorrow, they would finally
get to Vancouver.

page twenty
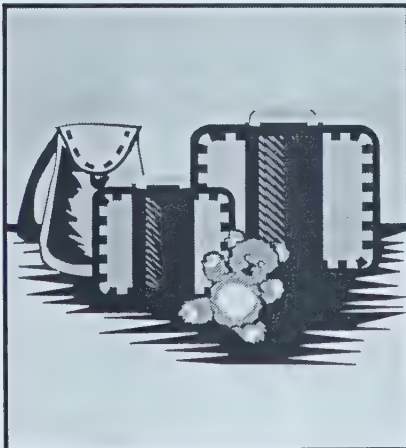
In the morning,
Christine dressed up
in her best yellow dress
with the white collar.

She helped her Mom pack
the bags and suitcases
and then they stepped
off the train.

On the platform of
the train station,
    her family was there
    to greet them.

Christine's Dad and
    her brother James waved,
"hello, hello, we're glad to see you,
        we're glad to see you".

The next day Christine,
        James, Mom and Dad
    went down
to the nearby ocean.

The sparkling water
        swept ashore, waving,
"hello, hello, we're glad to see you,
        we're glad to see you".

Appendix D – Hypercard Scripts

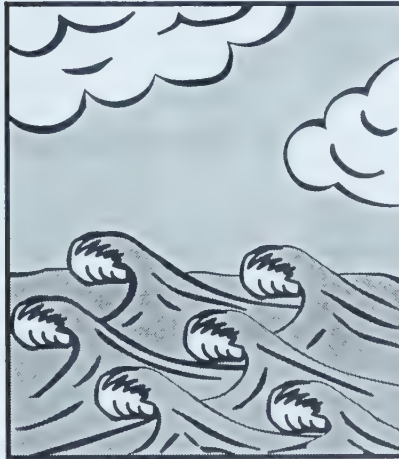Scripting in Hypercard can range from simple English-like commands to complex programming. Many times, an author can use Hypercard's buttons to create an action that in turn, generates the script automatically.

Here are some examples of the scripts from the IMMI application of "We're Moving!".

Example 1:

Is from the first stack, and is used to automatically add in the required colour and hide the menu at the top of the screen at startup.

Example 2:

Is the title card's information upon opening. All boxes and menus are hidden.

Example 3:

Is the first page story's sound button script. When the button is clicked on, the sound of waves, a resource labelled "S1-r" is heard.

Example 4:

Is a navigation stack button's script to instruct the program to go to a specific page in the story stack. The watch will appear so the user knows to wait.

1

```
on openStack
  AddColor install
  set cursor to watch
  hide menubar
  pass openStack
end openStack

on openCard
  Send colorMe to this card
  pass openCard
end openCard

on closeCard
  lock screen
  pass closeCard
end closeCard

on colorMe
  AddColor colorCard,stamp,30
end colorMe

on closeStack
  AddColor remove
  pass closeStack
end closeStack
```

2

```
on mouseUp
  hide MenuBar
  hide tool window
  hide pattern window
  hide the message Box
end mouseUp
```

3

```
on mouseUp
  play "S1-r"
end mouseUp
```

4

```
on mouseUp
  set cursor to watch
  go to card id 4799 of stack
"We're Moving! story"
end mouseUp
```

Curriculum Vitae - Jane Tilley Merks

Education

Master of Design (Visual Communication Design) 1995
University of Alberta, Edmonton, Alberta

Bachelor of Design (Communication Design) 1988
Nova Scotia College of Art and Design, Halifax, Nova Scotia

Bachelor of Fine Arts (Visual Arts) 1976
Concordia University, Montreal, Quebec

Diploma in Graphic Design (ANSCAD) 1987
Nova Scotia College of Art and Design, Halifax, Nova Scotia

Diploma in Fine Arts (Visual Arts) 1973
John Abbott College, Ste. Anne de Bellevue, Quebec

additional credit courses:
University of Alberta, Edmonton, Alberta (1993 - 1994)
History of the Book (Department of Library and Information Studies)
Interactive Multimedia Instruction (Department of Educational Technology)

Mount Saint Vincent University, Halifax, Nova Scotia (1989 - 1993)
Mass Communications (Department of Public Relations),
Marketing, Accounting, Business Administration
(Department of Business Administration)

audited courses:
University of Alberta, Edmonton, Alberta (1994)
Qualitative Research Methods (Department of Education)
Mount Saint Vincent University, Halifax, Nova Scotia (1988)
Introduction to Public Relations (Department of Public Relations)

other courses:
Case Binding (Edmonton, 1995)
Book Binding (NSCAD extension, 1991)

Work Experience

Teaching

Full Time Lecturer - Design Division July 1989 - June 1991
Nova Scotia College of Art and Design
   (Part-Time Lecturer — May 1989 - June 1989)
Courses taught:
   Intro to Computer Applications for Visual Arts
   Computer Graphics for Design

Computer Imagemaking

Manuscript to Mechanical

Communication through Publications

Part Time Lecturer - Public Relations Department Jan 1989 - June 1993

Mount St. Vincent University

Course taught:

The Role of Design in Public Relations

Part Time Instructor - Continuing Education Dept. Jan 1989 - July 1990

Nova Scotia College of Art and Design

Courses taught:

Intro to Macintosh for Designers

Various workshops for high schools students

MacFun - workshop for kids and adults together

Teaching Assistant - Department of Art & Design Sept 1993 - April 1994

University of Alberta

Course taught:

Visual Communication Design: Concepts and Systems

(instructor: Bonnie Sadler Takach)

Design Work

Interactive Multimedia Designer — May 1994 - present

Current Project:

Visualization for ATM Protocol Testing — a joint project with the Department of
Computer Science (Computer Graphics), University of Alberta, funded by Hewlett
Packard. The aim of this project is mainly to develop visualization techniques that
facilitate the detection of errors and performance problems in the data collected by the
protocol analyzer.

Recent Design Work

Graphic Designer — January 1987 - present

Projects have included the design and production of books, corporate identities,
brochures, newsletters, conference programs, and press kits.

Clients included:

Mount Saint Vincent University- PR Office

M.M.Mercer Tax Services Ltd.

Tourism Industry Association of Nova Scotia - Education and Training Department

Centre for Women in Business

Graphic Design Associates

Department of Advanced Education and Job Training

NSCAD Information Office

Ecology Action Centre

Other Work

Computer Lab Technican (part-time assistant) Sept 1987 - Dec 1988
Responsibilities included working with students, maintaining hardware and software, and keeping scheduling records for the Nova Scotia College of Art and Design Computer Centre, Halifax, NS.

Artisan (Self employed) 1978-85
Supplied fibre and porcelain work to various craft shops, first in Ontario and later in the Maritimes as well participating in regional craft markets.

Bookkeeper (part-time) March 1978-November 1981
Owned and ran G.E.Whiteley and Assoc. Ltd., an accounting firm in Nepean, Ontario.

Substitute High School Teacher April - June 1976
  Baldwin Cartier School, Pointe Claire, Quebec

Exhibitions

"Imagemakers'90" - group show (computer imagery) Co-ordinator
  Anna Leonowens Gallery, Halifax, October 1990

"Time4Dsign" - group show (visual communications)
  Sheraton, Halifax, NS, October 1990

"Graphics Interface" - group show (computer imagery)
  Anna Leonowens Gallery, Halifax, NS, May 1990

"Pixel" - group show (computer imagery)
  Anna Leonowens Gallery, Halifax, NS, November 1989

"Women's Work" - group show (fibre graphics)
  Kyber Coffee House, Halifax, NS, December 1985

"Brush, Pen and Needle" - solo show (mixed media)
  Dartmouth Heritage Art Gallery, Dartmouth, NS, November 1984

Sackville Crafts Association Group Show (mixed media)
  Owens Art Gallery, Mount Allison University, Sackville, NB, April 1983

Group Show (mixed media)
  Chateau Laurier Hotel, Ottawa, Ontario, October 1981

Graduating Students Show (painting)
  Concordia University, Montreal, Quebec, April 1976

Graduating Students Show (mixed media)
  John Abbott College, Ste Anne de Bellevue, Quebec, April 1973

Professional Activities

Society of Graphic Designers of Canada

Professional designations: MGDC Education (1989, LGDC (1992)

1989 Conference Co-Chair - "Mind Your Own Business"
    Atlantic Business Conference

1990 Moderator - Atlantic Design Education Symposium, Halifax, NS

1991 Moderator - 'Selling Design' Symposium, Halifax, Nova Scotia

1991 - 1992 Treasurer

1993   President (January to June)

GDCA Committee Work

1989   Membership Committee Chair, Member of Education Committee

1990   Education Committee Chair, Co-ordinator of Economic Impact
    Study of the Graphic Design Industry in Nova Scotia

1991   Member of Education Committee, Member of Nova Scotia
    Community Colleges - Graphics Departments Advisory Board, 1991

1992   Member of coordinating committee -
    Conference "Adapting to a Changing Environment"

1993   Board Member of ADBNS — Association for the Advancement of
    Design in Business, Nova Scotia Chapter

NSCAD Alumni Association

Member - 1989 - present, Board of Directors - 1990-91

Papers

co-author — *"Accounting for Design"*, presented at the "Mind Your Own Business"
design conference, Halifax – November, 1989

co-author — *"Assessing the Graphic Design Cirriculum of the Nova Scotia Community
College"*, prepared for the Department of Advanced Education, Province of Nova
Scotia, Halifax – 1991

co-author — "Visualization of Network Protocol Test Results", presented at the Sixth
Annual Western Computer graphics Symposium, Banff, Alberta – March 1995

Reference

Professor Peter Bartl
Art and Design Department
University of Alberta
Edmonton, Canada

CD ——————

University of Alberta

Inter-departmental mail
Correspondance interne

Name/Nom	Department/Departement	Address/Adresse

Master of Design Thesis – Visual Communication Design

The Presentation of the Visual Aspects of Interactive Multimedia Instruction

Department of Art and Design – University of Alberta

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Name/Nom	Department/Departement	Address/Adresse